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U. S. DEPARTMENT OF AGRICULTURE.

Report No. 84.

PROGRESS

OF THE

BEET-SUGAR INDUSTRY

IN

THE UNITED STATES

IN

1906.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief of Bureau,
Washington, D. C., March 25, 1907.

Sir: I transmit herewith the manuscript of the annual report on the Progress of the Beet-Sugar Industry in the United States in 1906. It consists of the report of the special agent, Charles F. Saylor, and a brief account of the lines of study and investigation pursued by the regular force of this Bureau.

I recommend that this manuscript be published as Report No. 84 of this Department.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary.

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PROGRESS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES IN 1906.

REPORT OF THE SPECIAL AGENT,

CHARLES F. SAYLOR.

INTRODUCTION.

I can not better introduce my tenth annual report on the progress of the beet-sugar industry in this country than by stating that the year 1906 has been in all respects the most successful year since the beginning of the industry in the United States.

We are now producing enough sugar (from beets and cane) in the United States to supply the population in the western two-thirds of our entire area, or enough to supply nearly one-third of the whole amount of sugar consumed in the United States. The beet crop has been bountiful in all sections of the country. Factories have received larger supplies of beets than at any other time, many of them more than it was practicable to manufacture into sugar. During the past year more plants have been built and considerably more capacity for manufacturing sugar has been installed than in any preceding year. The prospects at the present time are encouraging for 1907, and, in fact, the continuous development of this industry seems assured.

LAST YEAR'S FORECAST.

As a feature of my last report I took occasion to illustrate the magnitude of the sugar industry in the area lying west of the Mississippi River by comparing the estimated production of sugar in 1906 with the consumption of sugar in that area in 1900. This estimate showed that under normal conditions this region of our territory would have sufficient sugar-producing capacity to manufacture considerably more sugar in 1906 than the estimated consumption of that section for the last census year (1900). I attempted to portray graphically the results of the rapid development of this industry. To state in tons the amount of sugar produced suggests to the average reader an indefinite idea as to the real magnitude of the industry, but the state-

ment that the population west of the Mississippi River is producing a surplus of sugar over and above its consumption conveys a startling fact which very few have realized. This graphic presentation had precisely the effect intended. In working out its details I calculated the probable production of 1906, basing my estimates on capacities of the sugar factories which were expected to be in operation, and assuming a reasonable length of campaign for these factories. I added to the estimated total manufacture of beet sugar the actual production of cane sugar in the South in 1905, assuming that the production for 1906 would be the same. In a similar way I demonstrated that by combining the production of sugar east of the Mississippi River with the surplus of production west we had a total production exceeding by about 23 per cent the consumption of sugar west of the Mississippi River for the year 1900.

In that forecast I estimated the production of beet sugar for the entire United States for 1906 at 1,037,300,000 pounds. The actual returns for 1906 (see p. 104) are 967,224,000, only 70,000,000 pounds, or about 7 per cent, short of the estimate. The estimate would doubtless have been fully realized but for the fact that three of the older factories included did not operate and four of the new factories were late in completion and had light tonnage on account of small acreage planted.

The assumption that the cane-sugar product of Louisiana and Texas in 1906 would equal that of the previous year was somewhat wide of the mark, as the latest estimates of the product for 1906 show it to be only about 71 per cent of the crop of 1905.

SOME IMPORTANT FEATURES AND BENEFITS OF SUGAR-BEET CULTURE.

A few of the important features and benefits of sugar-beet growing deserve special consideration.

WORK OF THE FACTORY AGRICULTURIST.

There are now in the United States 64 beet-sugar factories. Each of these factories has an official known as an agriculturist. It is part of his business to study the problems presented by the climate, soil, and other conditions of his locality. It is his further duty, after arriving at conclusions, to promulgate them and to offer practical suggestions to the farmers interested in growing beets for his factory. As a rule the agriculturist of a factory has from three to a dozen assistants who are well fitted for their work. Directly, and indirectly through these assistants, the agriculturist is in constant communication with the farmers, advising and aiding them and insisting on the employment of right methods. Every farmer growing beets

for the factory is to some extent a pupil of this teacher of agriculture; and, to a considerable degree, the same is true of his neighbors, because they are constant observers of results.

Incidentally this agricultural superintendent of the factory discusses most problems that have to do with the farm because, directly or indirectly, they have some relation to the success of his manufacturing industry. Feeding, breeding, fertilizing, plowing, cultivating, harvesting, irrigating, farm physics, farm business, farm labor, and good roads are all related to the work of the sugar factory. This work of agricultural education kept up indefinitely must produce results of lasting benefit to any community. The farmers must, in the course of time, be greatly benefited, and their children are benefited still more. The lands and farm methods are directly improved. The community constantly rises in the scale of proficiency.

The sugar factory furnishes a thoroughly equipped laboratory, with a chemist and assistants to test the quality of the beets, to analyze the soil, the water, and the crude materials entering into the process of sugar manufacture. The factory management engages extensively in experimentation. It learns the quality of the soil and teaches how to improve it; it tests the quality of the beet seed; it studies meteorological conditions. A sugar factory not only becomes an active ally of the agricultural college, disseminating knowledge and teaching methods, but it also becomes an ally of the State experiment station, discovering new facts by actual experimentation. It provides all the facilities for doing these things, and all the crop producers of the community become the beneficiaries. No one is better advised regarding the potency of the educational work accomplished by the sugar factories than the agricultural colleges and State experiment stations. That they are of great value as aids to agricultural education and investigation is the enthusiastic belief of every agricultural college man in the States where sugar factories are located. The nation and the State pay large sums of money for conducting our agricultural colleges and experiment stations, but in the sugar factories we have an educational agency that is cooperating to a large extent in the work of these institutions without any direct financial aid from State or nation.

Observing these results from year to year, especially in the older districts where such influences have been longer at work and have accomplished most, I am convinced that the educational benefits are worth all that has ever been paid for the sugar factories.

SOIL IMPROVEMENT THROUGH BEET CULTURE.

Our population is increasing very fast, and to sustain it a greater demand is made upon the productiveness of the soil than ever before. Our methods of culture and soil improvement must keep pace

with our growth in population. As our areas per capita grow less, we must intensify our agriculture. By methods of soil improvement we must develop higher productiveness. Germany and France had to meet these conditions years ago. Their necessity required the discovery and application of principles resulting in greater productiveness of the soil. Agriculture was intensified through crop rotation, soil culture, and fertilization. In the beet districts of these countries these roots are grown on land worth from $300 to $800 an acre, and in some instances more. Nevertheless, these countries can produce sugar cheaper than we. The lower cost of labor has something to do with this, but the better and more careful methods of farming have a great deal more. We need to strive for the proficiency acquired by our foreign competitors, not only in the production of sugar beets, but of all crops. The sugar factories are tending in their respective districts to work out this evolution. Gradually, but surely, they are doing away with that style of farming which may be characterized as slipshod, careless, unscientific, and wasteful, and introducing the better methods represented in the beet fields of Germany and France.

The establishment of beet-sugar factories in this country has greatly promoted the investigation of soils. Before a factory is installed in a locality it is a matter of great importance to its financial backers to learn whether such locality has soils with the right properties. The constituent elements as well as the physical properties of the soil must be investigated. It must be assured that the farmer will receive sufficient tonnage and that the factory will receive beets of a suitable quality for sugar making. Some soils are adapted to beets; others are not. This has stimulated soil investigation, and has resulted in large additions to our knowledge of the soil.

BENEFITS TO LIVE-STOCK INDUSTRIES.

In the Mountain States, like Colorado, Montana, Wyoming, and Idaho, stock industry was formerly confined to grazing. Large herds of cattle and flocks of sheep roamed over this short-grass region. While this grass is short it is nutritious, and it has the peculiar quality of curing on the ground. In the States I have named it is possible to graze the year round, with very little protection to stock. The range must connect with a water supply. Often it is possible, without grain feed, under these conditions to put stock at the age of 4 years on the market of Chicago and other places fairly ready for the block. Formerly most of it was shipped into the corn belt farther east and fattened. Such States as Iowa, Kansas, Nebraska, Illinois, and Missouri usually prepared this stock for the market. The development of the sugar industry in these Western range States is rapidly bringing about a change in all this.

The sugar factory brings in the settler, breaking up the range. This is especially the case where it is possible to irrigate.

The pulp and waste molasses, together with the alfalfa hay grown in rotation with beets in these States, together with a little grain, afford an excellent fattening food ration. Most of these States grow barley, wheat, oats, and spelt, which, added to alfalfa and beet pulp, enable the feeders to finish their beef cattle for market considerably better than formerly. The grain requirement is much less than in the old fattening ration. By mixing it with their pulp and alfalfa these feeders can better afford to import corn from the Missouri River and fatten their own stock than to ship their cattle east for fattening, as formerly. For this reason these Western sugar States are rapidly diversifying their stock resources.

While the breaking up of the range has a tendency to reduce the number of stock the preparation of the stock for the market at home materially increases its total value. The stockmen are improving the grade of stock and thus increasing the importance of the industry. The same causes that intensify stock raising in connection with beet production also tend to the production of cheese and butter. The day of the open range on vast tracts is about over.

While stock production has been changing from the simple to the complex in the West, in States farther east like Wisconsin and Michigan sugar production has had a great tendency to amplify and improve the lines of stock industry already established. Wisconsin had accomplished much in dairying before the advent of the sugar factory. In the last two years the State has assumed considerable importance in sugar production. It has now five sugar factories, and, though young in the industry, the effect on the stock industry is very marked.

The State of Michigan, prior to the advent of the sugar industry, had no well-developed stock interests like the State of Wisconsin. In the last few years, however, the benefits of the sugar factory to stock feeding have begun to be realized and appreciated, and the State's progress in stock breeding and feeding gives evidence now of rapid development.

The sugar factory turns out large amounts of by-products adapted to the farmer's use for feeding. He can use this stock food to better advantage than people owning animals in cities and towns. He comes to realize this and naturally increases the animals on his farm. He directs his interests in stock to those lines best adapted to utilizing the by-product food—such as milk production, breeding, and fattening meat animals. He is constantly tending to an increase of animals on his farm to the extent of its natural food-producing capacity. He appreciates the necessity of building up and keeping

up its fertility. Rotation of crops—so necessary in beet growing—has in view the proper rest and reenforcement of the soil. To the barnyard the farmer naturally looks for one of the chief sources of his productive wealth. At the proper time in the cycle of rotation he resorts to effective soil fertilization. He plants his crops in rotation in accordance with the demands of the animals to be sustained. In this connection the by-products of the sugar factory are an important consideration.

INCREASE OF CROP RESOURCES.

One of the noticeable results of the sugar industry is its influence in increasing the crop resources of the various sections of the country. Probably the most noticeable effect of this phase of beet growing is to be observed in Wisconsin. In the country surrounding Madison about 12,000 acres of tobacco has been grown. In Rock County, surrounding Janesville, nearly a like area has been cultivated to tobacco for a number of years. In the necessity for preparing the soil and keeping it up to a high standard of fertility and tilth, and in the expense of doing this, tobacco is a crop more similar to the beet crop than any other. It has taken considerable time and energy to work tobacco growing up to its present status in these two sections. A sugar factory was located in each of these places. One has been in operation for three years and the other only during the last campaign, but both areas have been growing beets for some time to a considerable extent for the factory at Menomonee Falls, farther east in the State. The tobacco interests were very much alarmed at first. There was a tendency on the part of many of the tobacco growers to turn their acreage to beets. In many localities there was a large acreage of the tobacco lands planted to beets. At considerable expense new lands were prepared and cultivated so as to produce a crop of beets. As a natural consequence they were brought to a higher state of tilth than formerly. At the next planting the farmer must put in some other crop in rotation with beets. After he has grown a crop of beets he finds his land in admirable condition for tobacco.

During the four or five years beet growing has been in operation among the tobacco fields of Wisconsin this has proved the natural tendency. The beet-sugar industry has introduced tobacco growing into a larger field than it had before. It has become more profitable to grow tobacco on account of the relation of the two crops. A similar condition prevails in some parts of Colorado. Lands producing potatoes profitably for a long while must be changed to some other crop and rested. They are naturally in fine condition for beet growing, which is therefore introduced, and the beet crop leaves the land again in a great deal better shape for potatoes. It is found in those

irrigated States that they have more lands to grow alfalfa, potatoes, melons, wheat, and other cereals, from the fact that the sugar factory, on account of its superior capitalization, has increased the facilities, including labor, irrigation, rotation, and trolley and railroad lines for shipping.

The beet-sugar industry not only increases established crop production, but introduces new crops adapted to the conditions, especially of our newer sections of the country now developing. The United States Department of Agriculture has in recent years investigated agricultural conditions and crops in different parts of the earth, and has introduced into our own country valuable plants adapted to like conditions here. The beet-sugar interests have been responsive to this work, grasping the advantages and applying discoveries beneficial to this industry.

IMPROVEMENT OF THE SUGAR BEET.

From the inception of the manufacture of sugar from beets there has been a constant struggle for supremacy between the cane-sugar interests of the Tropics and those producing sugar from beets in the Temperate Zone. At the present time they are pretty evenly balanced in this contest. According to Willett & Gray, the world's production of sugar for the last year amounted to 14,305,823 long tons. Of this, 7,144,377 tons were credited to beets and 7,161,446 tons to cane.

From a plant yielding from 6 to 7 per cent of its weight in sugar, the sugar beet has been improved so that it will yield from 15 to 20 per cent, some individual beets going as high as 25 per cent. There is a marked tendency throughout the beet-growing districts of the United States year by year to increase the general average of sugar contents. The custom of holding prize contests has encouraged the production of better beets. These contests are conducted by county and State fairs, sectional and national expositions, and business and trade organizations. The important points on which the beets are scored in these contests are sugar content, yield, shape, cost of production, time of planting and harvesting.

The sugar content and purity of the beets are of the highest importance to the factory. If the purity is high, the expense of manufacture is considerably less. In many of our factories beets are bought on a sliding scale, or according to the sugar content and purity. In such cases the farmer benefits with the factory in the higher percentage of sugar and purity in the beet. In many other cases the farmer is paid a flat price per ton. Even in such cases he benefits indirectly by the higher sugar contents, because the factory can afford to pay more for beets if they are of better quality.

The tonnage of beets is the point that more particularly interests the farmer. It governs to a large extent his profit in growing the crop. Large tonnage benefits the factory indirectly, because it increases the amount of raw material to be used in the manufacture of sugar. The success of the factory each year is dependent largely upon the amount of beets it receives.

The shape of a beet has considerable to do with its merit. An ideal beet should be long and gradually tapering. That part of the beet next to the crown is not of nearly so high a quality as the rest. The shape of the beet is influenced by the nature of the soil, methods of cultivation, and its inherent tendencies. If a beet is bunchy, a greater portion of its rootlets are ramifying through the soil near the surface, more liable to be disturbed by cultivation and not performing so readily the important functions for which they are intended.

The cost of production is largely relative, depending upon the yield, the cultivation, fertilization, etc. The yield may be influenced largely by the inherent tendencies of the plant and especially the quality of the seed.

Seed production involves selection and breeding. If the proper methods have not been followed in producing it, there is a marked tendency toward reversion to poorer form and quality. The plant breeder aims to hold up the sugar content of the beet and at the same time to produce seed of higher vitality.

An important point in producing a crop of beets is to secure a stand. In order to secure a good stand it is necessary to plant many more seeds than are expected to grow beets. The higher the vitality the higher the germinating power of the seeds and at the same time the stronger the plantlets in resisting the obstacles with which they have to contend during their early stage of growth. Upon these things depend the stand and to a large extent the final yield. From the increase of yield there is more to be anticipated in the future development of the beet-sugar industry than from any other feature. Nowhere have we approached in any single instance the ideal yield, which has been calculated at about 43 tons per acre. I think the largest yield in any single case of a tract containing 10 acres or more was about three-fourths of the ideal, or about 33 tons per acre. Half of the ideal yield has been secured in a great many instances. In fact, there is hardly a district in the United States producing beets in which a few farmers do not secure 21½ tons. It is a matter of congratulation to note that in all of the older factory districts the average yield has grown considerably, and it is constantly on the increase. In recent years we have been building so many new factories, and consequently introducing the cultivation of sugar beets into so many new districts, that these higher averages of established beet-growing districts have been kept down to a general level of 8

to 10 tons. However, the tendency to higher tonnage after a district has grown beets for a while is a fact kept well in mind by those best posted on the progress of the industry. It is also kept in mind that to the scientific plant breeder must we look for increased yields in the future.

The time of planting and time of harvest are also important points as bearing upon the quality of the beet, these depending very largely upon the conditions and circumstances of the season and place. They also depend to a considerable extent upon the qualities of the seed, and are therefore matters of concern to the plant breeder. Conditions of place and season are matters that are fixed to a greater or less extent. Beets must be brought into adjustment with the conditions.

To the plant breeder are we looking for a higher sugar content and purity of the beet; for a higher yield and a better adaptation of the plant to its environment; for a higher vitality of the seed and of the plantlets, and for beets that will conform more nearly to the ideal in shape. This field of effort is now well and ably occupied. There is no other field crop or product of our soil that has received so much consideration and actual scientific investigation as the sugar beet.

One of the most important problems now occupying the attention of plant breeders is that of developing a strain of beets whose seed balls will contain but a single germ instead of several, as is the case with the ordinary beet. Each germ in the ball is likely to produce a plantlet, in which case the plantlets may intertwine, forming a tangled bunch. As all but one must be extracted from the soil, the one remaining must necessarily be disturbed and injured. The thinning process is one that must be performed by hand, and it can readily be seen that the expense is considerable. If the beet ball had only a single germ, much of the expense and trouble of thinning would be done away with.

The problem of producing the single-germ beet ball was taken up by the Bureau of Plant Industry of the United States Department of Agriculture four years ago. Annual reports on the work indicate that good progress has been made.

IRRIGATION AND SUGAR-BEET GROWING.

The influence of the beet-sugar industry on the development of irrigation is very marked in the newly developed agricultural sections of Colorado, Idaho, Montana, and Wyoming. From the beginning Utah, which was dependent upon its irrigating canals, projected extensive systems for watering the soil in order to produce ordinary crops. The same may be said to some extent of California. How-

ever, even in these States the sugar factory has had much influence in promoting irrigation improvement.

Colorado is the real reflector of the strength and power of sugar production as influencing active development of irrigation and the various productive interests based upon it. Fifteen years ago irrigation in this State was of the most primitive character. Its great, towering, snow-capped mountains and deep-cut valleys were not thought of as storehouses of wealth dedicated to agriculture. The water from the melting snows went leaping down its gorges and canyons and was carried away by the rivers. Agriculturally a stream of water was principally valuable for watering the grazing stock. The State was known to be rich in its mineral wealth, and attracted population and capital for investment almost solely for this reason. Its agricultural interests were slight in comparison. In recent years these have developed with gigantic strides. They very much exceed the mineral production of the State at the present time. In 1905 the production of sugar from beets alone in that State was very nearly equal in value to the silver production, and the output of sugar in 1906 leaves it far behind. The increase in this product has been phenomenal. Its estimated value in 1899 was $100,000; in 1906, $15,000,000. Ten years ago its irrigation systems were but poorly equipped and inconsiderable in extent. At the present time Colorado has many thousands of miles of main irrigating canals, connecting with a still greater mileage of laterals, and other large systems are under construction or in contemplation. At the beginning of the sugar industry these canals were principally ditches dug in the earth conveying water taken from the streams at various points. The system was poorly engineered and wasteful, resulting in a large percentage of loss due to seepage and to lack of frugal management. The few reservoirs in existence were mostly of similar character. The laws of the State regarding irrigation and the rights of the people to use water were as haphazard and indefinite as the system of irrigation itself. The legislature of the State has passed better laws defining and protecting these rights and more nearly placing the irrigating ditches under the proper regulations; and under the inspiration of the example set by the United States Government in its reclamation work the ditches and reservoirs now projected in the State are of the most substantial character. The wasting waters from the Rockies are being impounded in immense reservoirs of concrete construction, the overflow being caught up again by other reservoirs of similar character, with the mains constructed in the most durable manner of concrete and stone, and under the best of engineering skill.

In Colorado can be found some of the best systems of irrigation devisable by modern engineering talent, equal to the best constructed

anywhere else in the world. They are so built that they will withstand the destructive effects of the elements for ages, under a plan combining the control with the use and proprietorship of the land.

In 1899 Colorado had one small sugar factory; in 1906 it had in operation 15. Not only has the capacity of the original factory been doubled, but those built since have from two to four times the capacity of the original one. They are scattered along these irrigating ditches and are supplied with raw material from the farm lands brought into production by means of the water facilities thus afforded. There is hardly an irrigation system in Colorado of any importance which does not furnish water for growing beets for one or more of these factories. The building of recent ditches has generally followed the maturing of plans for constructing sugar factories.

What has taken place in Colorado is being rapidly duplicated in Idaho; a beginning has been made in Montana, and the time is surely approaching when a commencement will be made in Wyoming. Throughout these States natural conditions are quite similar; consequently they parallel each other closely in the development of crop resources. Rotation is the keystone of the scheme of agriculture in these developing States. Its importance is insinuating itself into the minds of agriculturists more rapidly than in those of our better-settled States of the East. This is due to the more limited crop resources of the West, the important ones being the root crops, represented by sugar beets and potatoes, in the order named, and the small grains—principally wheat, oats, and barley. Throughout the length and breadth of the arable territory in these States alfalfa is the principle legume. All of these crops yield abundantly. They are adapted for use in a rotation cycle. On account of the value of the sugar industry as a means for the promotion of organization and the attraction of capital, sugar beets have become a very important factor in the working plans.

In the West, to which irrigation is mostly confined, public-spirited business men have formed organizations devoted to the consideration of the best means and methods of the use of water. Associations, local, municipal, county, and State, devote much time to acquiring and distributing information pertaining to irrigation and the development which it induces. Whether the assemblage be temporary or permanent, the exposition feature is usually prominent. Usually a prize is offered for the best farm products grown under irrigation. These prizes are generally of considerable value, and excite enthusiastic contests.

With the progress of irrigation new sources of water supply are constantly being utilized. Irrigation was first effected from running streams. The limit of the supply of water was that furnished by the

flowing streams during the growing season. Later impounding the early flow and surplusage in reservoirs was resorted to.

In many parts of the country it was found that flowing artesian wells could be secured by penetrating the earth to lower strata. Many tracts of fertile lands not susceptible to irrigation from streams on account of location are now being supplied in this way. Other flowing wells are developed near the streams. Their waters are conducted into them and therefrom into the irrigating ditches, increasing the suply of running water.

It has been discovered that throughout the length and breadth of the irrigation sections following the rivers are immense amounts of sheet water and subcurrents, fed from drainage from higher lands, seepage from streams and irrigation ditches, and the final wastes from them. Recent developments of irrigation include the effort to secure these waters for use in irrigation. This is accomplished by pumping; sometimes by a single individual for a small tract of land, at other times by a company or a large corporation for the irrigation of larger tracts. For the purpose of the smaller undertaking the gasoline engine is found feasible and practicable. It is even found in many instances that irrigation can be effected in this way at a less cost than through the other methods. Where larger tracts of land are to be irrigated engines of high power are required, and these can be propelled by cheap fuels so abundantly distributed throughout the West in the form of wood, lignite or other varieties of coal, natural gas, and fuel oil. After many experiments, so practical has this system of irrigation appeared that the Government in its reclamation work is devoting large sums of money to the development of irrigation by pumping systems. In a paper written by F. H. Newell, of the United States Reclamation Service, we are informed that the most economical well for pumping purposes is one from 12 to 15 inches in diameter, penetrating to water-bearing gravels 30 to 60 feet in depth. In this paper he gives some of the items of cost, and for general information I quote a section of his paper, as follows:

A popular source of power for small pumping plants is the gasoline engine. Where the price of gasoline is high it is very easy to make the cost of water prohibitive by the use of such power. Whether or not it pays to pump water by gasoline is a matter which depends very largely upon the distance the water must be lifted and also upon the kind of crop that is to be irrigated. Gasoline, even at a high price, is usually a cheaper fuel than coal in an ordinary steam engine of small horsepower, such as a common traction engine. For plants requiring from 20 to 30 horsepower, producer gas generators can be installed which will keep the cost of pumping down to a minimum. A suction gas producer using anthracite pea coal for fuel should furnish power at the rate of 1 horsepower per hour for each pound and a half of coal consumed. At $8 per ton the cost of coal should be equivalent to gasoline at 4 to 6 cents per gallon.

It is very unlikely that it will pay to pump water under present conditions in the valleys of the western plains to a total height of more than 30 feet, includ-

ing the suction lift of the pump. If the pump lowers the water in the wells 10 feet, and if the distance to water be 10 feet below the ground, and the discharge pipe be brought into a reservoir or flume 5 feet above the surface of the ground, the total lift will be 30 feet, if 5 feet be added to cover loss of head due to friction in suction and discharge pipe.

In order to irrigate economically from pumping plants it is usually desirable to pump the water into a reservoir having a capacity equal to the amount of water the plant can furnish in six to eight hours. Such a reservoir is absolutely necessary for best results with small pumping plants. If the supply of water exceeds 500 gallons per minute, it is possible to dispense with the reservoir, especially if the supply greatly exceeds this amount. Plants furnishing over 1,000 gallons per minute can usually be best operated without the use of a reservoir.

PROMOTING THE SUGAR INDUSTRY.

To keep pace with the developments incident to the progress of the beet-sugar industry in the United States, my work must necessarily change somewhat. Originally the public desired information as to the adaptability of soil and local conditions. Now sugar factories have become so widely scattered throughout the beet-growing area that these conditions have largely been determined. Without much trouble or travel farmers themselves can go into the beet fields and study the methods of culture and the results of growing beets on the different soils. At present the thing most desired, where conditions are favorable and the soil is adapted, is information as to the best methods of securing the introduction of the sugar factory. A large part of my correspondence, conversation, and public efforts is to educate the people how to become directly and actively participants in the sugar industry. Nearly every locality in a beet-sugar district possesses the ambition to have a sugar factory of its own. I shall devote a short chapter along the lines of consummating this laudable ambition.

WORKING UP LOCAL INTEREST.

The first effort should be directed toward arousing a local interest. This should not only consist in a desire to secure a plant, but in a knowledge of local advantages and conditions. To attain this knowledge organization must be effective and earnest. The community seeks the introduction of an industry affecting not only its agriculture, but its general business interests. It is a direct or indirect benefit to everybody. Successful effort requires the cooperation and activity of all interests. The capitalization of an ordinary sugar plant is about $500,000. The bulk of the money received from its output of sugar is paid out in the local district for the beets, labor, and crude material necessary in its operation. With a successful plant, for beets alone the farmers of a tributary area will receive at least $250,000 annually; for labor in the factory, fuel, and other

crude materials the factory will expend over $50,000 more—that is to say, three-fifths of its original investment is distributed each year to the business, farming, and laboring people in this area. Everyone interested in the community's progress should thoroughly appreciate this and should work accordingly.

BEET-GROWING EXPERIMENTS.

The first fact of interest to a sugar-factory capitalist investigating such conditions is the probabilities of beet growing. He desires to know the quality of the beets and the probable yield. This knowledge can only be acquired by tests. These tests must be thorough and under approved methods. Considerable guessing was done in the early establishment of sugar factories, but those days are over. People in a locality desiring a plant now must be prepared to furnish the detailed facts and complete information. The best way to accomplish this is by organizing all interests in the community into an effective association for promotion and experimental purposes. The most convincing experiments are those that yield practical results. This association should arrange with the management of some operating sugar factory, if practicable, and contract to furnish it a definite acreage of beets. This should be done if the receipts from the beets only pay the expense of production and delivering. They should be grown under the regular supervision of the factory management, according to approved methods. Exact data should be secured as to tonnage, sugar contents, and purity of the beets; as to the character of the seasons and other conditions involved. If arrangements can not be made with such a factory, then suitable plats should be selected and planted experimentally. These beets should be grown according to approved methods and under the direction of some one thoroughly versed in beet growing. Possibly the beets will have to be sold to local stock feeders for less than the cost of production. It costs something to find out things. If the community is in earnest, the resulting information is worth it.

Whatever the method adopted to test local conditions, it is generally necessary for this association to raise sufficient funds to capitalize the experiment and to defray the expenses of working it out. Very few factories are built now in localities not thoroughly tested for beet growing. In most instances the tests consist in growing sugar beets for some near-by factory until the enterprise has grown to a sufficient extent to sustain one locally. If the community has not had this experience, then nothing short of a practical, well-directed and governed experiment will satisfy the investor in sugar manufacture. As an illustration of the insistence on this point, I will mention the facts leading to the building of several factories in the various parts of the country during the past year.

One of 350 tons capacity was built at Visalia, Cal., largely upon experimental information, but this had covered a series of years. Some beets had been grown at different times for distant factories. Another was built at Hamilton, Glenn County, Cal., of 1,000 tons capacity, after thorough experimentation such as I have outlined. The same is true of the factory built at Glendale, Ariz., which is a plant of 800 tons capacity.

One was built at Billings, Mont., of 1,200 tons capacity, after years of most thorough experimentation throughout the valleys tributary to this point. Not only was experimentation and promotion carried on at considerable expense, but an association had been active for a period of several years working to this particular end.

A factory was built at Nampa, Idaho, of 750 tons capacity, after complete experimentation and practical growing of beets for delivery to factories in eastern Idaho and in Utah.

A factory was built at Brush, Colo., of 750 tons capacity. Several hundred acres of beets had been produced in this community during several seasons. The same is true of Fort Morgan, Colo., which established this year a plant of 600 tons capacity. Swink, Colo., which is near two sugar factories, established a factory this year with a capacity of 1,200 tons. This community has been growing for several years a large acreage of beets.

A factory of 600 tons was completed at Charlevoix, Mich., which had been several years building, and every year has been growing a considerable acreage of beets and disposing of the same to other factories in that State.

It must be evident that information bearing upon beet production must be of no haphazard or indefinite character. The factories built last year went into districts almost as thoroughly tested as the older factory districts. There are a great many other districts for which the necessary data have been accumulated, which are yet without factories, but seeking them. Quite a number will secure them during the coming year. It must be understood that no community with ill-defined or poorly ascertained facts at to its conditions for beet growing has any sort of opportunity against such communities as I have just described.

CONCESSIONS TO PROMOTE FACTORY BUILDING.

Under this head it is not my aim to suggest the proper course, but simply to relate what is done either occasionally or ordinarily. In closing the details the factory builder often requires a donation of a certain acreage for a site. He may require of local capital a definite subscription to the stock of the company. From the transportation companies he may ask a specific and low freight rate covering his raw products and supplies, certain switches and side tracks at the

factory, and country dumps for loading beets at some distance from the factory. The local authorities may be asked to rebate taxes or not to assess the plant for a definite number of years; a demand may be made that water be furnished the factory for a certain stipulation or free for a time; that sewage connections be made with the factory, and possibly that indemnification be guaranteed against damage to streams due to factory drainage. There are many things that he can ask and does ask. All these things suggest the necessity for an active committee or association or some central head to arrive at definite conclusions and settle the preliminaries.

CONTRACTS WITH FARMERS TO GROW BEETS.

A sugar-factory investor will not only insist on ascertaining that beets of the right quality and quantity can be grown in the community, but he must have the assurance that if a factory is built they will be grown. Before builders of plants will close an arrangement for their installation they must be furnished sufficient contracts with the farmers to assure a complete supply of beets. These contracts may be for one or two years or sometimes as high as five years. The local association must be ready to furnish this contracted area before it can hope to establish a sugar factory.

No one can appreciate, unless it is a local committee or the managers of a factory who have gone through the ordeal, the trouble, delay, and disappointment incident to securing contracts with the farmers. The farmer is naturally conservative. With the ordinary farmer the necessary routine of the farm is not one developing a wide experience in business affairs. A community may be apparently thoroughly aroused, all its business interests in sympathy, and seemingly everyone in perfect accord regarding the desirability of locating a sugar factory. Only when the contract is presented to the farmer does the actual difficulty become apparent. He is engaging to do certain specific things for a definite time. He wants to know all about them. No matter what the public instruction has been, the matter must be gone over thoroughly with each farmer. He must have time to talk it over and think over it. He wants to ask questions. He will think of different questions, according to his peculiar temperament. In securing 5,000 acres of land, 1,000 to 3,000 farmers must furnish the contracts. As a rule this involves meeting and satisfying many different temperaments. While all this requires the most patient, painstaking, and careful industry, the farmer is acting from correct principles. You are introducing a new thing, entirely outside of his experience, which has not been sufficient to enable him to act on this specific thing. I desire to suggest that it is the absolute duty of those taking upon themselves the arduous task of securing these contracts

to prepare themselves for the ordeal. If the reader, who may be interested in such an enterprise, could see and know, as I have, the number of deserving projects that have fallen down for lack of proper method and detailed information on the part of their promoters, he would appreciate the importance of this suggestion. The farmer should be instructed as to the benefits. Too often in securing these contracts men are sent out who are poorly advised as to the real merits of the case. I recall an instance where it was thought advisable to use for this purpose a lot of local fire-insurance agents, simply because they were known to be good talkers. Whoever is selected for this work should know the benefits this industry carries to the farmer and to the community. It is a simple story, but a logical one. Like everyone else, before he acts he has a right to know where his interests lie, the same as if he were buying land, stock, dry goods, insurance, or anything else. No one would think of selling any of these without being able to present its merits.

POINTS THAT APPEAL TO THE FARMER.

There are a few points that always appeal to the farmer. The sugar-beet crop is one that does not fluctuate in price. He knows in the beginning what he is to receive per ton. He is not subject to the hazard of a falling market when he sells his crop. In fact, it is sold before he produces it and at a price satisfactory to him.

Most farmers are aware that there is a general tendency to deterioration of their soils from constant cropping. Any crop which gives the land a chance to recuperate appeals to them. The thorough stirring of the soil and superior tilth and general cleaning up of the land used in growing sugar beets, the necessity of fertilization, and the ability of the crop to carry the expense are things that he will consider.

He may hesitate on account of the scarcity of labor. When he appreciates that the sugar factory represents an organization especially adapted to, and interested in, securing labor, and bringing it in by carloads, he feels better satisfied.

He usually hesitates on account of the extraordinary expense involved in growing sugar beets. He must be impressed with the greatly superior net profits of this crop over others. He can be given tangible evidence showing actual results of farmers in other parts of the country, or general averages of a whole neighborhood growing sugar beets. At the same time he can be convinced of the general rise in land values and the high rentals paid for land growing beets; both of which, as a rule, double and sometimes treble after the sugar factory has been in operation long enough to demonstrate its usefulness.

It is always good policy, where possible, to take excursions of farmers from such districts into districts actually growing beets for a sugar factory. Let them mingle with such farmers and gain from them the facts of their own experience as to the benefits. Let them see a sugar factory in operation.

Many farmers will object to the nature of the labor in connection with sugar-beet growing. Thinning and weeding by hand while on one's knees is not a work or a posture agreeable to the average American farmer. Bending over the rows and crawling along them on one's hands and knees all day long are things that the contracting farmer is sure to object to as drudgery. It is an arduous job, and the point must be met and explained on its own merits. Our farmers ride on their stirring plows, cultivators, and many other implements. Naturally they do not look with much favor upon any crop that tends to deviate from this system. The tendency of modern farming is away from its drudgeries rather than toward increasing them; it is also toward a greater independence of the farmer. As a rule our lands are farmed by the owner. We differ in this respect from the European beet growers. Beets are grown in those countries under a system of tenantry.

In the original consideration of this subject of beet growing most farmers assume that they must do this work themselves. We are making inventions and devices for the purpose of eliminating as much as possible the hard work and hand labor. But ordinarily a farmer must expect that there will be a good deal of hand work. It is only in the intensified crops that he is justified in investing capital in labor to any considerable extent. Beet production costs about $30 an acre in those States where sugar beets are grown under rain conditions, and about $40 an acre in States under irrigation. Most of this cost is for labor. It is not at all necessary that the farmer should do any of this hand labor himself. The sugar-beet crop is one that will pay for its own labor cost. The farmer can plan to do by himself and his farm hands the actual team work, which is very similar to that necessary with other crops. The land must be plowed and harrowed, and the crop must be given usually from three to five cultivations. In the harvest the beets must finally be plowed out. The hand work is a feature entirely distinct from this. There is a class of labor accustomed to and inclined to do this hand work. They take it in preference to any other kind of work. As a rule they have been reared to do it. It is the work they know the most about, and apparently the one they desire most to do. They have become inured to it. It is a calling with them. The beet-growing farmer can usually contract for all the hand work, which includes bunching and thinning of the beets, hand hoeing, hand weeding, and the hand work of harvesting after the beets are pulled. This hand work of harvest-

ing consists in lifting the beets from the soil after they are loosened, bumping them together to jar loose the adhering dirt, clipping off the tops with a sharp knife, throwing them in piles, and finally loading them into wagons to be delivered to the factory. The prevailing cost under contract for this hand labor in the sugar-beet fields is about $20 per acre. The estimated cost to the farmer for his team work, seed, etc., in growing beets under rain conditions is about $10, making a total of $30 per acre. In the irrigated districts about $10 is the estimated cost of water and putting it on the soil through irrigation, making the actual cost about $40.

To the farmer who objects to the nature of this hand work it is only necessary to explain that the beet crop will take care of the cost and that the sugar factory attracts the laborer to do the work; if necessary, secures it for him.

Now, when the farmer has been advised of the direct benefits of the sugar-beet crop—a sure and stable market, soil improvement, availability of labor and ability to hire the same, and increased land and rental values—he must be enlightened on a list of incidental benefits. He should appreciate the favorable influence beet culture has on his farm and general farm products. The deep plowing necessitated in the preparation of the seed bed, the stirring it receives during its several cultivations and harrowings, and the plowing again at harvesting thoroughly loosen and pulverize the soil. The fact that it is kept entirely clean and free from grass and weeds makes it a better producer of any other crop that may be planted upon it. This effect is to be felt for several years and very much adds to the productive power and future utility of the land.

The benefits do not stop with the crops; they are felt in stock production as well. No farmer can begin to appreciate, until he has experience, the value of molasses and sugar-beet pulp—by-products of the sugar factory—as a food for stock. Of these every sugar factory is turning out at least half the original weight of the beets. Pulp is immediately available for the farmer's use; it is easily stored and kept; as a rule, it is considerably cheaper than any other feed he can buy or produce. Usually this pulp can be purchased at the factory for 35 cents to $1 per ton. Such low prices must necessarily continue for some time.

To appreciate the use and benefits of these by-products requires time. This is the usual experience of every sugar factory. In delivering beets the farmer can take home a load of pulp, making the cost of delivery very slight. Our State experiment stations in those States in which sugar factories are operating have been conducting exhaustive experiments to demonstrate the value of this pulp compared with other kinds of food. According to the purpose of feeding, the animal fed, and the local cost of various feeds, fresh pulp

varies in actual value as a feed from $1.50 to $2.50 per ton. As a rule, in disposing of this pulp factories give their beet producers advantages over competitors. This is always true where committees have developed considerable competition in securing it.

The benefit to the animal eating pulp is of two kinds—nutritive and sanitary. Where feeding is considerable and pulp is used as one of the main ingredients of the food ration stockmen insist that its sanitary effect is of vital importance. It is generally desirable for hogs, sheep, cattle, and horses, and especially valuable in milk and meat production and for breeding animals. Especial attention is called to this fact. In the fattening ration we are inclined to use too much condensed hot feeds; this leads to stomach and intestinal disturbances; mixing pulp with these feeds corrects these disturbances, promoting the animal's health and a tendency to lay on fat and choicer, juicier flesh.

One of the leading concerns of every farmer is good roads. A farm rightly conducted is of little avail unless it is possible to connect it with the market or the transportation lines by means of good roads. Good roads in a farming community are a prime necessity of every sugar factory. Nothing in a community redounds so much to the interest and benefit of a farm. On account of its insistence on road improvement, if for no other reason, the factory is of prime importance to the farmer.

In the sugar-factory districts throughout the country many other industrial enterprises follow the establishment of factories. While they are not parts of the plant, they are natural adjuncts. They are institutions helpful to the farmer's interests, demanding his products, intensifying the local market for them, and broadening his field of operations. The development of facilities and subsidiary industries expands and matures the agricultural status of the community and increases the acreage capable of more extensive and intensive farm husbandry. Among the industries that often follow the establishment of the beet-sugar industry are creameries, cheese factories, and canneries devoted to the preparation of foodstuffs, such as canned corn, tomatoes, peas, beans, and fruit; also picking establishments and the like.

A sugar factory in a farming district is sufficient guaranty of good roads, railroad transportation facilities (both trolley and steam), rural telephone lines, the best methods of intensive farming, and such appliances and implements as are best adapted to profitable production. These all work for the betterment of the farmer's status and for higher values of his products and his farm. All this is capable of demonstration to anyone giving careful investigation. These are matters of which the farmer should be advised when he is asked to sign a contract for the production of beets for the sugar factory.

In promoting a project for building a sugar factory, not only is the farmer brought into working sympathy and given an understanding of his interests, but unison of action on the part of the business interests is promoted. Every business conducted in a sugar-factory town is made to feel its helpfulness. As a rule, these factories go to the smaller towns and villages rather than to our important cities. Rather than incur the expense of taking the raw product to a large city, the sugar manufacturer finds it more practicable to take the factory to the raw product. For beets and other necessities required in manufacturing sugar a factory annually pays out several hundred thousand dollars in the community where it is located. This materially increases the local per capita circulation. This money is used in local business and increases the prosperity of the whole community.

WORK OF THE PRESS.

The newspapers are a strong factor in disseminating information regarding the beet-sugar industry. It should be the aim at all times to give the public plain, uncolored facts. There is a tendency in promoting a sugar-factory project to highly color everything pertaining thereto. Often the cost of production is understated, the profits are magnified, and the laborious work for the farmer is concealed. All of these should be stated frankly and openly in the beginning. A new industry as complex as this, before it can be declared a success, has many obstacles to meet and problems to work out. It takes two or three years to get the working machinery of the whole scheme into most successful operation. In order to gain that confidence and patient cooperation which is necessary for bringing the enterprise to a successful issue the statements made should be conservative.

NEW FEATURES RELATING TO FACTORY OPERATION.

Improvements in all matters affecting the beet-sugar industry are constantly being introduced. From the inception of the manufacture of beet sugar in Germany and France and more recently in our own country there have been constant improvements and experiments tending to a better status from year to year.

DRYING BEETS.

From time to time in the European beet-sugar countries, and to some extent in our own, experiments have been conducted with a view to changing somewhat the physical character of the beet before it enters the factory to be used in the manufacture of sugar. The aim of these experiments has been to make extraction of the sugar easier and cheaper. Some beet-sugar manufacturers believe if the

beets could be dried before extracting the sugar several advantages would be gained. At least 80 per cent of a sugar beet is water. The first thing necessary in manufacturing sugar from the juice of the beet is to eliminate this water by evaporation. Dried beets could be more easily stored, would require less room, and would not be subject to injury from freezing, fermentation, and other influences which induce chemical changes, inversions of sugar, etc. The length of a factory campaign under such conditions would be greatly extended. A factory could dry enough beets during the time now devoted to an ordinary campaign to run it the rest of the year. It is probable, however, that such a factory would begin manufacturing sugar as at present, while its substations would be drying beets for its later operations.

It is plain to be seen that such a factory could consume a much larger tonnage annually; it could employ its working force and machinery more economically on account of this extension. It could eliminate to a considerable extent the hazards from freezing and thawing of beets and the losses due to chemical action from different causes. The cost of transporting raw material would be lessened. The energy required for evaporation would be directly applied, and much more economically.

Most of the experiments directed to testing the availability of drying processes have indicated favorable results. They have not, however, been conducted on a scale sufficiently large to give reliable information as to comparative costs of the dry and green processes, or as to the possible deteriorating effect of the drying process on the quality of the sugar in the beets.

Mr. George W. McMullen, of Chicago, appreciating the value of such a process to the sugar industry, has been conducting experiments of more than usual extent with this end in view. He has invented a process for drying beet cossettes. I condense a few of the important points presented by him in a report he has made on the subject to the American Sugar Industry and Beet Sugar Gazette.

To an extent his experiments have deviated from earlier ones, since he would first slice the beets, as is now generally done in the factories, drying the cossettes instead of the whole beet. His plan is to erect substations in various parts of the beet-growing area, giving each a total capacity of about 10,000 tons per campaign, or 100 to 150 tons daily. At these substations the beets would be washed and sliced, and the slices, or cossettes, would be passed through the drying kiln, eliminating their moisture. He has conducted these experiments through two campaigns in connection with the management of the Menominee River Sugar Company, at Menominee, Mich. He is associated in his experiments with Mr. Z. G. Simmons. Both are in-

terested in the lumber business and have large kilns for drying lumber. In these kilns have been tested the drying of beet cossettes. This was done at a temperature of about 155° F. The beets used in the experiment were of a high grade, analyzing before the test 16.2 per cent of sugar, and showing 87.6 purity. After the cossettes were dried the sugar contents remained the same, and the purity was increased to 88.6. Tests were made in the diffusion batteries to compare the ease of extracting the sugar from these dry cossettes with those of green cossettes, under equal temperature and with an equal number of cells. It is claimed that the juices in eight cells of the dry cossettes were extracted as fully as those in ten of the fresh cossettes. He claims from this a saving of 20 per cent in the quantity of water used for diffusion, which, in a thousand-ton plant like the one at Menominee, would be equivalent to a saving of $60 per day. His plans for a plant of this size would be as follows: There would be an expenditure of $500,000 for drying plants, in addition to the $1,000,000 for the sugar factory. Such a factory could be operated the year round, having a campaign five times the length of the usual campaign at Menominee. This would virtually multiply the capacity of the plant by five, or increase it from 60,000 tons of beets to 300,000. This investment of $1,500,000 would accomplish as much work as a plant or plants now requiring an investment of $5,000,000. He calls attention to the economies and advantages in labor, freights, markets, etc., of a factory working all the year. He gives an estimate of the saving of expenses as follows:

> At Menominee they evaporate water at an estimated fuel cost of 23⅓ cents per ton, 1,200 tons daily, or $280 cost of coal. This cost is approximately correct for all the Northwestern sugar plants. The average freight on beets is about 70 cents per ton from the grower to the factory. The water can be taken from the beets at a fuel cost of less than 25 cents per ton, and the other expense at the drying plant would not bring the total cost as high as the freight saved on the water itself.

He calls attention to the saving of insurance, interest, etc., on the difference, $3,500,000, in the investment in the two plants. The process would redound very much to the benefit of the farmer. The drying plants would be located near the beet fields, making a shorter haul by wagon. On account of the very much increased slicing capacity of the factory, all beets could be delivered as soon as ripe.

The results of the experiments made by the inventor become all the more interesting in view of the fact that Mr. Treskow, the technical superintendent of the factory, participated in them.

In order to procure directly from the Menominee factory management information bearing on this work, I wrote Mr. W. G. McCormick, the manager. Below will be found his reply, accompanied by

correspondence between himself and Mr. McMullen, giving his opinion and the results of the factory's part in the experiment:

MENOMINEE, MICH., *January 8, 1907.*

DEAR SIR: I take pleasure in replying to your favor of the 20th ultimo relative to the experiments made with dried beets.

Probably the best way to answer your question is to inclose the correspondence between myself and Mr. McMullen, the inventor of the drying process, in connection with this work.

In the clipping sent they have made an error in the statement as to the cost of the erection of a plant large enough to do this work in a practical manner. It is my opinion that such a plant would cost about $25,000 if made large enough to handle about 300 tons of beets per day.

It is my opinion that this drying process can be put into practical use; and if it were done, I feel quite certain, as stated in my letter to Mr. McMullen, that it would revolutionize the beet-sugar industry, because it would enable one main factory to do the work of five or six and at the same time make a very considerable saving in maintaining the sugar in the beet in its integrity as it comes from the field. I am very certain that the loss by deterioration resulting from handling the crop as is now done is very much greater than most beet-sugar manufacturers realize.

Sincerely, yours, G. W. MCCORMICK.

CHICAGO, ILL., *March 13, 1906.*

Mr. G. W. MCCORMICK,
Manager of Menominee River Sugar Company,
Menominee, Mich.

DEAR SIR: As Mr. Cook, vice-president, and yourself visited Simmons, Mich., and examined my system of evaporation, and you have since that visit carefully followed the various tests made with dried cossettes at your works under your own direction, I take the liberty of asking your replies to the following questions, which I have endeavored so to frame that your answers will convey to beet-sugar manufacturers a definite idea of the scope of my invention:

1. Is not my system of evaporation, as you have observed, plainly in accordance with natural laws and so designed that the products treated can be freed from water without disturbing the chemical relations of the ingredients to each other?

2. Do not the tests show that the sugar properties in the sugar beets are fully preserved; and, further, that, after a considerable interval, there is no deterioration or loss of sugar in the dried cossettes; and would it not therefore be possible for factories to accumulate in the fall, by drying, a sufficiently large quantity of beets to enable them to operate practically the year round instead of a few months, as is now done?

3. Would not the heavy loss of sugar incident to deterioration from freezing and thawing of beets in changeable northern climates be obviated if the beets supplied should be dried and preserved in perfect condition immediately after harvesting?

4. Do not your laboratory tests demonstrate that the sugar can be as quickly diffused from the dried cossettes as from fresh beets and with much less water, and in consequence may not considerable saving be effected in daily evaporation?

I shall be much gratified to receive your replies to the above and such further expressions of your practical views as will put the matter plainly before the beet-sugar manufacturers.

Very respectfully, yours. G. W. McMULLEN.

MENOMINEE, MICH., *March 15, 1906.*

Mr. G. W. McMULLEN, *Chicago, Ill.*

DEAR SIR: I am in receipt of your letter of the 13th instant relative to your process of drying sugar beets and the results of our experiments carried on in connection with this work. In reply to your first question I would say that I visited your drying plant at Simmons, Mich., in company with Mr. C. I. Cook, and witnessed the drying of some fresh sugar-beet cossettes, the beets having been sliced in the regular way and carefully tested by our chemist for sugar contents and purity before being dried. In observing your method of drying I was impressed with the fact that you had discovered a very simple and natural law in connection with removing moisture from materials, and was surprised at the simplicity of your device; and so far as sugar beets are concerned, would state that from tests made by our chemist of the dried cossettes we were unable to find that there was any disturbance of the chemical relations of the properties of the beets, and I think this is largely accounted for by the fact that the evaporation, or drying, takes place at a low temperature.

In answer to your second question would state that from the analysis made in our laboratory of the dried cossettes, as compared with the analysis of a sample of these same fresh beets before drying, we found that the full sugar contents had been preserved and the purity remained the same, and, so far as we could ascertain, no deterioration had taken place at that time; and, from a series of experiments made at intervals for a few months following the drying of the beets, we could find no changes in sugar contents or purity in these dried cossettes. We shall continue to have experiments made for a much longer period and ascertain if any changes will take place later on. Should we find that there are no changes, I believe it would be fair to assume that, with a sufficient supply of these dried cossettes, a sugar factory would be enabled to operate practically the year round. One factory would thus be able to do the work that five or six are now doing.

In answer to your third question: It would appear from our experience, and, no doubt, from the experience of every sugar factory, that there is a very considerable loss of sugar each year from deterioration through freezing and thawing of the beets or from other causes between the time the beets are harvested and the time they are actually made into sugar by the factory. This was especially true the past season with all factories in this latitude that had any considerable quantity of beets to work up. Were it possible to dry the beets immediately after harvesting, and thus preserve them perfectly, a very considerable saving in sugar would be effected.

In reply to your fourth question, I would state that we prepared in our laboratory a miniature diffusion battery of 14 cells and proceeded to extract the sugar from the dried cossettes. In conducting this experiment our experts were exceedingly careful in their work, and after a series of experiments we found we could extract the sugar by diffusion from the dried cossettes as readily as we could from the fresh ones, and the experiment showed that we could perform this work with much less water. Of course any sugar manufacturer realizes the economy that would be effected by having less water to

be evaporated from their juices; and, as our superintendent reported, this could be done without affecting the operations adversely at the other stations in the house.

So far as our experiments have gone in this work, I might say that there seemed to be no obstacles to be contended with in the drying of the beets by your process and the manufacture of sugar from such dried beets. What remains to be demonstrated, of course, is of very considerable importance, and that is, Could drying plants be erected at outside points and operated at a cost which would enable the sugar companies to install them and proceed along this line? One thing is evident, and that is that there should be a very considerable saving of freight, as between 70 and 80 per cent of the weight of fresh beets would be removed in the form of water; but as to the cost of this part of the operation I am unable to judge, and believe that the only way to demonstrate this in a practical manner would be to erect a slicing and drying station at some point and make an actual test; and, if it is then found that this work can be economically performed, it would seem that a problem had been solved which would, to a very great extent, revolutionize beet-sugar manufacturing.

Yours, respectfully,

G. W. McCormick.

Mr. F. Treskow, general superintendent of the Menominee River Sugar Company, writes as follows:

I am pleased to inform you of the very satisfactory results we had by experimenting with cossettes dried by your drying process. I am certain that cossettes previously dried by your process at a temperature not higher than 155° F. and stored until such time as they would be needed for manufacture will not deteriorate to any appreciable extent. These cossettes will give no difficulty in the diffusion battery or at the following juice stations of the house, and I believe that the extraction in the diffusion battery can be carried on with less water—at least 20 per cent less—which means a great saving in evaporating, and also an increase of capacity of all stations of the beet end.

It can not be said that the process of drying beets, or even the cossettes, prior to extracting their juices by diffusion, has as yet been practically established. Enough of importance has been ascertained by experimentation to make it worthy of more careful and comprehensive tests in the future. Granting that this process will eventually prove practical, it promises a reduction in the cost of sugar produced from beets.

DENATURED ALCOHOL IN RELATION TO THE SUGAR INDUSTRY.

At the present time, on account of the recent law passed by Congress regarding denatured alcohol for use in the arts and sciences, much interest has been aroused in the minds of farmers. The Department of Agriculture has recently published three Farmers' Bulletins relating to this subject, No. 268, devoted to "Sources and manufacture," No. 269, to "Uses and statistics," and No. 277, treating of "Alcohol and gasoline for use in farm engines." These bulle-

tins are for free distribution by the United States Department of Agriculture.

This subject is receiving careful attention from those interested in sugar production, both from cane and beets. Great benefits are anticipated, both directly and indirectly. The manufacture of certain alcoholic spirits has for some time been closely allied to the sugar industry. In the Tropics rum is one of the special by-products of sugar making. The low-grade molasses and juices are used for this purpose. In the beet-sugar countries of Europe an extensive alcohol production has developed in connection with the manufacture of sugar from beets. For this purpose is used the low-grade molasses of the sugar factories. In both Germany and France alcohol is made to a considerable extent directly from beets. More attention is given to this in France. In the United States we have one plant making high-grade alcohol from the waste molasses of the sugar factories, and another for this purpose is being planned.

England has recently enacted laws permitting the use of denatured nontaxed alcohol in the arts and sciences. By legislation Germany and France have encouraged its manufacture for a considerable time. The law of the United States enacted for this purpose went into effect January 1, 1907. In all the countries named legislation encouraging this industry is considerably more liberal for the purpose than our own. People of the United States probably anticipate greater benefits than will accrue or the facts will warrant. No doubt this law lays the foundation for the production of a new and cheap product, greatly benefiting many industries. The bulk of it will continue to be manufactured, as now, by the plants already equipped for producing the alcohol product on a large scale or by other plants requiring large investments. There appears to be a popular impression that every farmer can be a producer of alcohol from his farm products, no matter how small the output. As a matter of fact, any individual can now, as heretofore, engage in alcohol production who will comply with the law; but the actual situation is that only those prepared to go into it on an extensive scale can compete. No new discoveries have been made augmenting the uses of alcohol. Most of its present uses have been appreciated for some time. The only thing barring it from practical application to these uses has been our internal-revenue tax of $1.10 per gallon. National legislation simply relieves the maker of alcohol from paying this revenue, conditioned on his changing its nature so as to prevent its use as a beverage. This legislation specifies certain ingredients in specific proportions which must be added to what is known as ethyl alcohol, rendering it unfit for beverages, medicines, etc. The manufacturer of alcohol must conform to the same rules and regulations

that were previously in force. He pays the same revenue. However, upon notice to the Government that he wishes to denature certain quantities, it will permit him, under its supervision, to add the ingredients it specifies for this purpose. This alcohol is then considered denatured, becomes tax free, and may be removed from bond and sold to the general public for use in the arts and sciences.

The main benefits that will accrue to the farmer will be the stimulus to crop production of those things from which alcohol is made. There is quite a number, such as corn, barley, potatoes, sugar beets, and a number of other plants and roots carrying a large percentage of starch or sugar, or both. It is claimed by those best advised on this subject that alcohol free from revenue tax can be produced to retail for 30 to 35 cents per gallon. This will very much stimulate its use for the various purposes to which it is applicable, and to that extent stimulate the increased production of the different manutures requiring it as a raw material.

It will undoubtedly benefit the rural classes in another way. There has been a great development in recent years in the application of cheap fuel to the production of light, heat, and power. Light engines doing all kinds of work are found practicable on the farm. They are used for grinding feed, shelling corn, cleaning wheat, sawing wood, thrashing, pumping water, and many other things requiring power in the daily routine of farm work. Those inclined to look into the future anticipate that such power will eventually be used generally in propelling stirring plows, cultivators, thrashing, reaping, and mowing machines, and in doing much other work now generally performed by horses. As a rule the gasoline engine has ordinarily been used for such purposes. A thorough study of the situation shows that denatured alcohol may take the place of gasoline to some extent. It is claimed that certain qualities of alcohol make it very much preferable to gasoline. In burning it is less odorous, does not smoke, nor leave a dirt refuse. While the flame is light blue, the heat is intense. Directly it would not serve the purpose of illumination. This can only be accomplished by converting it into an incandescent light by means of a mantle over the flame. This has the property of absorbing the heat rays, becoming incandescent, and reflecting white illuminating rays. For heating purposes this product may be found quite useful in places remote from sources of cheap fuel, such as coal, petroleum, wood, and gas.

Alcohol is used extensively in the production of smokeless powder, varnishes, hats, imitation silk, and, to greater or less extent, in the production of a number of things for which the denatured article can be used. No doubt the lessening of its cost on account of this new law will very much stimulate and assist many industries, and for this

reason its effect will be far-reaching. Time and experience only can demonstrate the most practical sources of its manufacture. Possibly in the end the principal raw materials used in its production may be the by-products from the manufacture of something else.

Dr. H. W. Wiley, Chief of the Bureau of Chemistry, Department of Agriculture, in Farmers' Bulletin No. 268, gives the following table, showing the yield from 100 grams of sugar of the following quantities of the products of fermentation:

	Grams.[a]
Alcohol	51.10
Carbonic acid	49.20
Glycerin	3.40
Organic acids, chiefly succinic	.65
Ethers, aldehydes, furfurol, fat, etc	1.30
Total weight of fermentation products produced	105.65

In the same bulletin he refers to sugar beets and the production of alcohol from them as follows:

The sugar beet is often used directly as a source of alcohol. Working on a practical scale in France, it has been found that from 10,430 tons of beets there were produced 183,624 gallons of crude alcohol of 100° strength. The beets contained 11.33 per cent of sugar. From 220 pounds of sugar 15.64 gallons of alcohol were produced. The weight of pure alcohol obtained is a little less than one-half the weight of the dry fermentable matter calculated as sugar subjected to fermentation. About 18 gallons of alcohol are produced for each ton of sugar beets employed.

In the same bulletin Doctor Wiley speaks of the manufacture of alcohol from molasses, a by-product of the sugar factory, as follows:

The utilization of the waste materials from the sugar factories and sugar refineries for the purpose of making alcohol is a well-established industry. The use of these sources of supply depends, of course, upon the cost of the molasses. When the sugar has been exhausted as fully as possible from the molasses, the latter consists of a saccharine product containing considerable quantities of unfermentable carbohydrate matter, large quantities of mineral salts, and water. In molasses of this kind there is probably not more than 50 pounds of fermentable matter to 100 pounds of the product. Assuming that a gallon of such molasses weighs 11 pounds, it is seen that it contains 5½ pounds of fermentable matter, yielding 2¾ pounds of industrial alcohol of 95 per cent strength. It requires about 3 gallons of such molasses to make 1 gallon of industrial alcohol. The quantity of molasses made in the United States as a residual product from the sugar manufacture is difficult to determine. For each ton (2,240 pounds) of sugar produced we may assume that there are 62½ gallons of molasses. Placing the total output of sugar in the United States at 400,000 tons, beet and cane combined, would give a yield of molasses of 25,000,000 gallons.

The quantity of molasses produced in Cuba is three or four times as great as that produced in the United States, thus affording a very extensive source of production of industrial alcohol should it prove profitable to make it from this

[a] One gram equals 0.03527 ounce.

material. The above data show that when the price of molasses delivered to the refineries falls as low as 5 or 6 cents a gallon it may be considered a profitable source of alcohol.

In 1905 13,500,000 gallons of alcohol were produced in France from beet-root molasses. The production from this source is decreasing—in 1901 almost double the above amount was made.

Representative E. J. Hill, of Connecticut, who assisted Commissioner Yerkes, of the Internal Revenue Bureau, to formulate the rules under which free alcohol went into effect, spent considerable time in Europe investigating the subject. He has outlined the conditions in Germany under which the farmer can practically and profitably manufacture alcohol. He states that Germany is the country in which the greatest progress was found to have been made in the direction of applying denatured alcohol for the development of industrial purposes. There are 70,000 farm distilleries in Germany, many of them being very small. Mr. Hill was asked how the German Government could afford to furnish an inspector to each one of these distilleries. In view of the fact that it has always contended that distilling from residues from beet-sugar manufacture could be carried on only on a large scale, Mr. Hill's information is particularly interesting to the American beet raiser. He says:

There is no difficulty in that respect. The stills have to be made in a certain way, which includes a tank which can be locked with a Government lock and sealed with a Government seal. The small farm distilleries do not operate all the year round. They operate in the winter, when the farmer has leisure to do something other than straight farm work. The farmer has to give the Government thirty days' notice as to the time he wants to begin to operate his still. Some time during the thirty days an inspector comes along and looks the still over to see that it is clean, etc., and then he locks and seals the tank, after which the still is ready for the farmer.

He may go ahead and distill until the tank is full. Then he informs the person who is to buy the alcohol from him, after which he notifies the Government and an inspector comes and removes the seal, measures the contents of the tank, and collects the revenue. If the farmer wants to denature the alcohol on the spot he can do so in the presence of an inspector, when the amount of the tax will be returned to him. But generally the farmers sell through the great central selling agencies, which denature at a central point and in large quantities and collect the rebate from the Government in considerable sums. Thus the Government agents are not required to spend any appreciable time at any one farm and one inspector can cover a large territory. Meanwhile the central selling agency pays the farmer on the basis of beverage alcohol and rebates for all that is denatured. It is a good system and is not very expensive to the Government.

From Farmers' Bulletin No. 269 I clip a table showing the consumption, and for what purpose, of denatured alcohol in France, 1903 to 1905, inclusive:

Consumption and uses of denatured alcohol in France, 1903–1905.

Purpose for which used.	1905.	1904.	1903.
	Gallons.	*Gallons.*	*Gallons.*
Heating and lighting	8,326,084	7,654,287	6,922,218
Varnishes	305,222	328,443	305,909
Polishes, etc	46,415	47,552	66,095
Plastic materials	562,497	495,874	530,851
Manufacture of hats	6,023	6,287	9,642
Dyeing and colors	14,635	10,329	14,054
Rennet	3,910	2,932	3,751
Collodion	11,016	7,185	3,857
Chloroform	4,914	4,596	9,959
Chloral	10,091	7,978	6,499
Tanning materials	14,978	40,920	21,081
Chemical and pharmaceutical products	178,843	182,410	300,652
Scientific uses	31,515	22,824	13,710
Ethers, fulminates, explosives	2,961,900	2,375,342	1,687,495
Total	12,478,043	11,186,959	9,895,773

IMPROVED IMPLEMENTS AND DEVICES FOR THE BENEFIT OF BEET GROWERS.

During the past ten years many changes and improvements have been made in the implements used in the cultivation, harvesting, and delivery of beets. The farm wage scale of this country is considerably higher than in any other. Wages have advanced considerably during this period. Anything that tends toward the saving of labor affects to that extent the cost of production. To balance the gradual increase of farm wages, we must introduce new labor-saving implements. I note a general improvement of all implements used, and special endeavors on specific ones, which, when perfected, will be far-reaching in their results.

BEET HARVESTERS.

To harvest beets costs from $5 to $10 an acre, depending upon the condition of the soil. Most of this work is now accomplished by a system borrowed from Europe. This consists in extracting the beets from the soil with an implement drawn by two to four horses. It is in the nature of a plow. There are several forms, one of which is called a "puller." This has two finger-like tapering prongs which run through the ground parallel with the surface, but about 10 inches below. The space between these prongs is wider at the points, gradually lessening to their back ends. These prongs are supported by two upright pieces attached to the beam. When pulled through the soil the points are carried on either side of the beet, compelling it to pass through this diminishing space. Directly the prongs tighten against the beet as it is being forced through the space, breaking off the top root and forcing it up. The beet is elevated 2 or 3 inches and left in the loose dirt.

Another form of the implement consists of a plow with a narrow moldboard and a long sharp knife-like share, the edge of which penetrates the soil at about the depth of 10 inches, cutting off the beets, lifting them several inches, and throwing them on the side over against the loose dirt. A workman comes along the row, takes hold of the top, lifts the beet from the loose soil, and with a sharp knife cleaves off the crown from which the leaves have grown. The beets are then bumped together to remove the adhering dirt and thrown in piles, and the tops in others. From these piles the beets are loaded into wagons and delivered to the factory.

Harvesting involves considerable hand labor. A man and team can only plow out one row at a time. Inventive ingenuity in Europe, and especially in America, has been directed to planning a harvester which will do away, as far as possible, with this expensive hand work. Quite a number of harvesters for this purpose have been devised. Some of them are intended to do only a part of the work described; others are more complex, and are planned to accomplish all of it. For instance, one machine is designed simply to pass over the row and cleave off and pile the tops. Several others not only remove the tops, but extract the beets and place them in piles. Some implements have been constructed which top the beets, have an arrangement for jarring off the adhering dirt and forcing their surface against a system of brushes, thus cleaning them as fully as possible. Some have an elevator to carry the beets into a wagon drawn along the side of the harvester.

It can not be said that any of these newly devised implements works successfully in all soils. No doubt great improvement is made from year to year. The present drawback to an absolutely universally competent machine is the variable nature of soils. Some soils are mellow sandy loam, from which the beets are easily extracted; others are compact and hard, requiring considerable power. The amount of moisture at harvest plays an important part. The more complex the machine, as a rule, the more power required, and the heavier the implement. There is no doubt that most of these machines do acceptable work under the conditions of soil for which they were more particularly designed. The obstacles have been largely overcome in particular cases, because the problems have been studied and the difficulties met. It is the universal harvester we are now seeking. It is the general belief of those most interested in the beet-sugar industry that it will be perfected eventually. When it is, it will solve one of the main objections offered by farmers to beet growing. It will materially reduce the expense of their production.

As an evidence of the importance of such an implement, I clip from The American Sugar Industry and Beet Sugar Gazette of May 5, 1906, the following:

Consul Hannah, writing from Magdeburg, says that the Verein der Deutschen Zuckerindustrie has offered a prize of $2,380 for a machine that will solve the problem of satisfactorily digging beets and heading them at the same time. The papers of the contestants are to be sent so as to reach the main office of the association up to July 15, 1906. The decision as to the granting of the prize will be given by a board of judges selected by the director of this association and will be published. The prize will be awarded as soon as a beet digger and header has been shown which satisfies all requirements.

METHODS AND DEVICES FOR UNLOADING BEETS.

I note a very remarkable change throughout the country in the means and methods of delivering beets to the factory. Like harvesting, this is a rather expensive feature. Not only have better devices for this purpose been arranged for the use of the farmer, but better systems have been inaugurated for the saving of his time. A few years ago it was quite common to see farmers waiting their "turn" in a long line at the factory. The beets were thrown into the bins by hand with shovels or beet forks. By very much increasing the capacity of the beet sheds this congestion has been considerably eliminated. It is also becoming quite the custom after the sheds are filled to pile the beets on the ground by the railroad tracks, etc., in the vicinity of the sheds, permitting them to lie there until worked. Many factories have added dumping facilities for depositing a carload of beets in the bins at once. Some factories use a system of nets. Two or three of these are placed in a wagon box before the beets are loaded. The bins are equipped with hoisting cranes which take hold of these nets, lift them, and thus drop the beets into the bins.

Probably the best wagon-dumping device of a sugar factory is that at Fremont, Ohio. The bins are so arranged that the wagon-load of beets is driven over them onto an automatic dump. The team is then unhitched from the wagon and the whole load of beets is precipitated into the bins below. This performance requires only three to five minutes. These long beet bins are arranged side by side. It is necessary only to have one set of automatic dumps. They are on tracks running at right angles with the bins and can be made to travel from one bin to another.

Aside from the general improvement in dumping facilities at sugar factories, there is to be noted a tendency quite prevalent throughout the beet-growing area to build "country dumps." These are located outside of the 6-mile or wagon limit. At some feasible

point the railroad puts in a side track and switch. Along this is erected an automatic beet dump, with long approaches at either end. This country dump is usually equipped with a weighing and sampling station. The farmer drives up the incline with his load of beets after weighing and sampling by the agent. The wagon is then hauled upon the dump and fastened securely to it after removing the team. By automatic action the beets are thrown down over an apron into the cars below. This greatly increases the area growing sugar beets. In my reports I have noted the introduction of these country dumps from time to time. They are coming generally into use. There are of course some objections to automatic dumping. It has a tendency to increase the tare of the beets and to deposit a large quantity of dirt and refuse in the bins. This dirt tends to choke up the sluicing ditches which convey the beets to the factory and requires considerable expense in removing it.

Automatic dumping of sugar beets, either at the factory or in the country, is receiving careful study from factory managements and designers. The three points of improvement aimed at are to increase the efficiency, decrease the cost, and eliminate the objectionable features.

I have devoted considerable investigation to dumping. Sometimes it is possible to adopt a device already worked out for accomplishing a certain work and made to do service somewhat similar in kind yet different in purpose. A short while ago while in a heavy corn district in the State of Illinois I observed in operation a combined corn dump, elevator, sheller, grinder, and conveyor of the ground corn to the feed lots or barn. The process was very simple. A wagonload of corn was driven along a large granary, the front wheels were allowed to drop into certain elongated cups about 8 inches deep, conforming to the shape of the wheel. The team was detached from the wagon and hitched to an ordinary horsepower used in operating the dump. The back end gate of the wagon box was removed; the power was started in motion. The cups were elevated, carrying with them the front end of the wagon until it reached the inclination necessary for precipitating the corn into a box below. Through the bottom of this box, attached to a belt, were cups or conveyors for carrying the ears of corn up an elongated box receptacle and dropping them into the granary, or sometimes it carries them to the sheller. After shelling another conveyor takes the grain to the grinder and another to its final destination, possibly feed boxes in the yards. All this was accomplished by the horsepower outside. The features capable of adaptation to the beet industry are the outside apparatus, consisting of the horsepower, elevator of the wagon front, the box receiving the load, and the conveyor to the top of the granary. In the case of beets this would be the bins. With modifica-

tions for use in beet delivery all of this might be made very useful. For this purpose I would add one or two things to complete its usefulness. The bottom of the outside elevator carrying the beets to the top of the bins should be openwork, made of round steel bars, through which the loose dirt could fall. For catching this loose dirt under this elevator conveyor I would have another receptacle attached to a crane and automatic weigher. This method would separate the loose dirt and débris from the beets, weigh it, and dump it back into the wagon. With very little trouble the farmer could haul it to some common dumping ground. A device of this kind would be advantageous in two or three respects. It would keep out of the bins the loose dirt which causes objection to automatic dumps. It would weigh this dirt in the presence of the farmer and do away with a great deal of the contention occasioned by the present system. Now the farmer must rely solely on the fairness of the factory agents in estimating his tare from the samples of beets taken.

BEET WAGONS.

I notice considerable transformation of the vehicle used in conveying the beets to market. Formerly as a rule beets were hauled in ordinary farm wagons, with the usual boxes. We see now for this purpose many specialized forms of boxes. These are devised to haul as large a load as is practicable and to unload as easily as possible. In many of these are introduced certain features of automatic dumping. Forms of these boxes are various, all tending to accomplish the most in the easiest manner, at the least expense. In the most favored beet-growing districts one or more devices are adopted with these ends in view. I clip from the Hutchinson (Kans.) News of Thursday, August 2, 1906, an article on one of the newest devices arranged for this purpose:

To facilitate culture and enable them to produce and deliver their crop with the greatest ease possible seems to be one of the chief endeavors of the United States Sugar Company in behalf of the farmers who are to supply the factory with beets for the campaign. To this end still another departure is being made in the line of implement equipment.

Two hundred beet wagons or dumps are now being manufactured here in Garden City and will be sold to the beet-raising farmers at cost, which will probably exceed but slightly $55. The one object of this is to render beet delivery easy and prompt.

The new dump will consist simply of a body with drop sides, bottom and sides giving away simultaneously from the center at a touch upon a lever by the driver, who does not leave his seat. The beets fall into the bins in the shed below and on either side. The sides are automatically replaced and the outfit is then driven on.

There are to be two sizes made, the 3-ton and 4-ton. The contrivance can be used on a standard running gear—that is, a 38-inch bolster.

USE OF GANG PLOWS AND STEAM ENGINES IN STIRRING THE GROUND.

Stirring of the ground is one of the particular features in preparing the seed bed. This should be thorough and, as a rule, at greater depth than is usual for other field crops. Owing to exigencies of the season it is desirable to cover considerable in a short time. The sooner the plowing of land is accomplished the better. Prevalent weather conditions may retard the plowing and planting. The pressing requirements of other crops may limit the farmer's time. It is desirable to have the land ready to plant at the most favorable moment. Weeds germinate and get an early start. We can cultivate and harrow the lands and get much of the weeds and grass killed before planting begins. If this plowing is done early, it gives the farmer much more opportunity for doing the preliminary work of preparing the seed bed. The necessities of the case have been so thoroughly demonstrated to the farmers in the beet districts that they are alert to learn and adopt all the best methods for accomplishing this work.

The lay of the land in many of our beet districts is well adapted to the traction plow propelled by steam or other power. During the past season progress was made in the introduction of these plows, and from local reports it would appear that their adaptability to the purpose proved highly satisfactory. It is evident they will be used much more in the future. I observed that this system of plowing lands was quite generally in use in the Hawaiian Islands. In those islands plantations are large, even-surfaced tracts, mostly belonging to or leased to the sugar companies. Planters there exercise all of their ingenuity and skill and utilize all their advantages. Since beet growing succeeds best where there is full utilization of the highest advantages, I predicted several years ago that some of the advanced methods in the Hawaiian Islands would eventually be employed in the beet-sugar industry in this country. In the introduction of the steam gang plow we see a fulfillment of this. While the gang plow has come into use in several sections of the country, its use is not general. I reproduce here an article taken from the Tulare (Cal.) Weekly Register of March 23, 1906. This gives a specific account of the operation of one of them:

A representative of the Register this forenoon visited the scene of operations on what is known as the "Goldman colony tract," near Tagus, where Mr. J. S. Montgomery is superintending the planting of a large acreage to sugar beets for the Tagus Sugar Beet Company, of which he is a member. A big traction engine is the principal factor in the work, and it is moving over the land with three six-disk plows and a Randall plow in its trail, cutting up 30 acres a day. The ground is being plowed to a depth of 12 to 14 inches, and as I rode around on the back of one of the plows and watched the sod curling over from the 18 disks I mentally contrasted present methods with those of my childhood, when I sat on the fence and watched my father, with the lines

noosed over his neck, steering a single plow behind a span of horses. This traction engine is built for three more similar plows, giving a capacity of 60 acres a day.

In another part of the immense field a seeder was at work, and to-morrow two more will be put on, as the cessation of the rains has given the plows and harrows a chance to get ahead again. On that part of the tract where the seed was planted before the rain stopped operations, the beets are showing themselves conspicuously in rows farther than the eye can reach.

That there will be a fine crop of beets on that land there is no room for doubt, as the company has one of the best pumping plants in the country and the soil can not be surpassed anywhere.

FLUMING BEETS.

During the past year I noticed the introduction experimentally of fluming beets to the factory. This practice is quite general in cane production in the Hawaiian Islands. It has been used in this country to a considerable extent in other lines of industry. In Hawaii much of the cane is brought in by fluming from the fields to the factory or to some point on the road accessible to it. As a rule the ground is gently sloping from the cane field to the factory. Flumes are made of wood and galvanized iron or other material similar to these. In form they are triangular, with cross section like the letter V. In our lumber districts much of the lumber, wood, posts, and billets is brought from the sawmills in the mountains to the highways and railroads by floating through a flume. There are many places where fluming would be a practical method for conveying sugar beets to the factory. In Hawaii considerable of the fluming apparatus is portable. The main flume may be stationary and permanent. Side flumes for conveying the cane to the main channel are movable from field to field. This system would not only convey the beets to the factory, but thoroughly cleanse them. Taring would be reduced to the minimum, and a part of the work of the factory would be accomplished.

An experiment in fluming beets was made at Bozeman, Mont., last year. The people in this vicinity are very anxious to secure a beet-sugar factory. They have carried on experimentation in growing the beets to a considerable extent. I reproduce here an article written by A. Buchanan, of Bozeman, to the American Sugar Industry and Beet Sugar Gazette of June 5, 1906. He had charge of this experiment and gives the results as follows:

An experiment in transportation that may be of interest to manufacturers and growers throughout the country has just been successfully concluded here, and, it is believed, has solved the problem of handling beets in a section where other means of transportation are limited, but where there is an abundance of water. The gentlemen who are promoting the sugar industry in Bozeman have been confronted by a difficult problem. A large part of the choicest acreage in the Gallatin Valley is outside of the 5-mile limit, and in one part of this

district considerable acreage has been signed up, subject to the erection of a slicing station. The amount of acreage, however, has hardly been sufficient to justify the building of an extensive slicing plant, so the promoters have cast about for other means of getting the beets to the factory at a small cost. A suggestion by one of the sugar-beet committee that the beets be flumed to the factory was taken as a practical one, and the experiment was concluded recently.

The trial was made with a flume that runs from the Gallatin Mountains to Bozeman and is used for carrying railroad ties from the forests that cover the mountain sides to the railway at Bozeman. The flume is a V-shaped wooden box with sides 24 inches, set together at right angles. This left the open top about 34 inches across. For this experiment a volume of water that filled the box about halfway to the top was used. The flume has an incline of 1 inch to the rod, or a little over 26 feet to the mile. The distance covered by the experiment was a mile and a quarter. About half a ton of beets were used in the trial, and these were dumped into the flume as rapidly as possible, in order to "bunch" them. The beets arrived at their destination without mishap, the last of them getting there within eight minutes after they were put into the flume. When they were taken out of the water, they were as clean as if they had gone through a washer.

While it may appear that too heavy a drop was utilized, that will have no bearing on the practical nature of the experiment in this valley, as the land here lies at about the same angle, and in many places the slope of the valley is even greater. There is plenty of water that can be utilized here for fluming, and all of the prospective acreage is considerably higher in elevation than the proposed factory site. By building a main flume up the valley and having feeders at convenient intervals, it is believed that beets can be delivered at the factory in clean condition for far less money than even a slicing station can handle them.

Further experiments, in which a flume with less drop to the mile will be used, will be made as soon as the special flume can be constructed, but those who witnessed the experiment are fully satisfied that beets can be floated down to the factory without difficulty even with one-third of the drop above mentioned.

While the experimenters are thoroughly satisfied with the result of the trial, they realize that there may be some unforeseen objections that a factory expert might point out, and I therefore submit this brief account of the experiment in order that those more familiar with the business may pass upon it.

The farmers in the Gallatin Valley are planting about 200 acres of beets this year as an experiment, under the direction of a factory expert from Ogden. These will be shipped to the Billings factory.

CLIMATIC CONDITIONS AND FARM AND FACTORY RESULTS FOR 1906.

The progress of the beet-sugar industry can be determined best from actual results. Under this heading I give a résumé of conditions obtaining in the various parts of the United States, outlining to some extent the general character of the season during 1906.

FACTORIES IN OPERATION.

Taking the country as a whole, no other year has presented results so generally satisfactory. All things considered, the factories of the United States are approaching the season of 1907 under most favorable auspices. As a rule farmers are contracting for acreage readily and seem well satisfied. There are now sixteen States in which beet-sugar production is going on. In the table below will be found the number of factories in each, with the capacity of each, and the total capacity for working beets per diem represented by the factories in each State:

Beet-sugar factories in the United States in 1906, with localities and capacities.

Location.	Capacity.	Location.	Capacity.
Arizona:	*Tons.*	Michigan—Continued.	*Tons*
Glendale	800	Holland	350
		Lansing	600
California:		Marine City[a]	350
Alvarado	700	Menominee	1,000
Betteravia	500	Mount Clemens	600
Chino	900	Owosso	1,000
Hamilton	1,000	St. Louis	600
Los Alamitos	700	Salzburg	400
Oxnard	2,000	Sebewaing	600
Spreckels	3,000	West Bay City	600
Visalia	350		
	9,150		11,250
Colorado:		Minnesota:	
Brush	750	Chaska	600
Eaton	600	Montana:	
Fort Collins	1,200	Billings	1,200
Fort Morgan	600	Nebraska:	
Grand Junction	500	Grand Island	350
Greeley	800	Leavitt	1,100
Holly	600		
Lamar	400		1,450
Longmont	1,200		
Loveland	1,200	New York:	
New Windsor	600	Lyons	600
Rocky Ford	1,000		
Sterling	600	Ohio:	
Sugar City	500	Fremont	400
Swink	1,200		
	11,750	Oregon:	
		La Grande	400
Idaho:			
Blackfoot	600	Utah:	
Idaho Falls	1,200	Garland	1,200
Nampa	750	Lehi	1,200
Sugar	1,200	Lewiston	600
		Logan	600
	3,750	Ogden	400
			4,000
Illinois:			
Riverdale	350	Washington:	
		Waverly	500
Kansas:			
Garden City	1,000	Wisconsin:	
		Chippewa Falls	600
Michigan:		Janesville	600
Alma	750	Madison	600
Bay City	600	Menomonee Falls	500
Blissfield	600		
Caro	1,200		2,300
Carrollton	800		
Charlevoix	600		
Croswell	600	Total capacity	49,500

[a] This factory was not in operation in 1906.

ARIZONA.

Agricultural conditions favorable to beet culture have been quite thoroughly tested in Arizona. For several years capitalists, promoters, business men, and farmers have conducted experiments in many of its valleys. Where favorable, conditions are quite similar to those in the valleys of California.

At a small place called Glendale, about 8 miles from Phoenix, Ariz., a factory has been located. Crop production here of all kinds is promoted largely through irrigation by means of ditches connecting with Salt River. Beets are usually of high quality, and the yield is good. This factory at Glendale has been constructed under a chain of very unfortunate circumstances, largely due to misconnections of plans of those building it. Its inception dates back nearly three years, and it has been building for over two years. Its construction was impeded by litigation. Before the building was completed or all of the machinery installed it got into the hands of a receiver. During the early spring of 1906 these matters were adjusted, a small acreage was secured under contract with the farmers, the building was completed, and its machinery and equipment installed. It ran a short, unsatisfactory campaign and got into further legal difficulties.

In this district beets should be planted early. It is the opinion of those best advised as to the conditions that planting should be done from the middle of December to the middle of February. This will permit the opening of the factory campaign from the middle of April to the 1st of May. Beet plantings for this factory in Arizona will occur earlier than at any other place in the United States. The beets will receive the rainfall of winter; at this place this is the most favorable growing season for crops of this nature. During the summer the weather becomes very warm and dry, and is not so favorable to sugar manufacturing as in the spring. Beets rapidly deteriorate when they are taken from the ground under such conditions—one of the things especially demonstrated during the past year. The campaign opened on August 11—very late—on account of tardiness in completing the plant. The management had contracted for about 3,000 acres. On account of the planters becoming discouraged from constant delays and unsettled prospects of the factory, considerable reduction of this acreage was made. Notwithstanding the lateness of the crop, the season was quite favorable and demonstrated much to the credit of the district in growing beets.

One thing especially is worthy of mention: The conditions are such that beets can be left in the soil for a considerable length of time after they are ready for harvest without deterioration.

It may be said that through the results of the past year's work the feasibility and practicability of growing sugar beets in the valley were thoroughly demonstrated. Under the reclamation act the Government is constructing near Phoenix one of the largest impounding reservoirs and irrigating ditches in the country. This ditch and its laterals are assured a permanent and sufficient supply of water for developing a large area.

While the demonstration of favorable agricultural conditions has been sufficient, on the other hand the operation of the factory itself was somewhat discouraging. Irrigation water for the lands is supplied from the Arizona Canal. At the same time the plant, for operating purposes, received most of its water from the same source. Shortly after beginning, the canal was subject to unusual and numerous floods and breaks, resulting very unfavorably to the factory's operation. The water became unfit for its use. For a sugar factory water should be pure and clear. The water coming to it through the ditch was dirty and charged with débris, necessitating special filters and other devices for clearing it. Even then a sufficient quality and quantity of water could not be secured to operate the factory. At the factory were two deep wells, upon which it drew for a partial supply. This soon became exhausted, making it necessary for the factory either to shut down or to fall back on its expensive system of clarification. An extensive break in the canal occurred, owing to one of these floods, which necessitated closing for a considerable time. Many of the beets had been harvested and lay in piles in the fields or in the bins of the factory. Owing to the prevalent hot weather which occurs in that climate at this period of the year, these beets rapidly deteriorated, occasioning considerable loss to the farmers and to the factory. Beets in the ground, not harvested, remained in very fair condition.

In addition to obstacles encountered by the factory through its inadequate water system were certain labor troubles. All these things tended to delay its completion and seriously affected its operation. Several of the experts brought to this point to engage in its operation became tired of waiting and returned home. It became necessary to use a number of unskilled persons in the factory's force. Phoenix is out in a rather inaccessible district. Labor is not easily secured, especially those skilled in the work of the sugar factory.

Through all these difficulties the factory managed to make raw sugar only. Sufficient white granulated sugar was produced to prove the factory's ability to turn out a first-class article. Under the conditions this was at prohibitive cost. The factory ran about twenty-five days and closed down. It was operating at too much expense. Farmers were notified to deliver no more beets; to weigh

them and make an account of them, as they would eventually be paid for, but they would have to be used for feeding and other purposes. These experiences were all very unfortunate. However, through it all the fact that sugar production has a place at Glendale was well demonstrated. The sugar industry's future in Arizona is somewhat in doubt. The affairs of the factory should be adjusted, permitting its practical operation. An ample supply of pure water for its use at all times must be guaranteed by the completion of the Government irrigating system and the sinking of more deep wells at the factory. Plans are being matured for bringing about these conditions, and it is fair to state that the factory will start out under more favorable auspices in its next campaign.

CALIFORNIA.

The first successful plant operated in the United States was at Alvarado, in Alameda County, near San Francisco. It has now been enlarged and improved to such an extent that there is very little of the old factory now in existence. It has, however, through its long successful career, established a permanent condition of beet production such as we may well look for eventually in connection with more of our factories. It has gone through all the phases of discouragement due to drought, disease, pests, and other things affecting the production of beets. These things are found to affect the beet crop through a long series of years the same as other crops, and not more often or accompanied with more hazard. Seasons have occurred in this district when there was failure to produce sufficient beets to run the factory except short campaigns. In a new district such an occurrence would be most discouraging. Its effect would be felt for several years to come. This demonstrates that confidence in this new industry can only be assured after several years' experience.

I have called attention in previous reports to the fact that some years ago California built factories beyond its assured production of beets. Several factories were built in a short period. Soon after droughts occurred and diseases attacked the fields, giving California factories short runs for several years. Each of these districts has been gradually increasing its beet-producing capacity and working up confidence similar to that at Alvarado. While several of the plants were enlarged during the past few years, no factories have been installed until the past season, when two additional new ones were built. This is one of the best assurances that the old ones have sufficiently developed the productive resources of their districts to assure ample supplies of beets.

Most of the factories in California are large—considerably above the average. It has two of the largest factories in the United States,

and one which is the largest in the world, with one exception. Most of the older factories were built on the coast, or near it. This was largely due to natural conditions favorable to beet production. On the coast side of the mountain ranges in California water seeps or percolates through the substrata of the soil from the mountains to the sea. To plants this affords a system of subirrigation. Until the last few years very few of the beets grown in the State were irrigated. Between the middle of January and the 1st of March, as a rule, the State has considerable rainfall, under normal conditions the precipitation ranging from 10 to 25 inches. During this period, for most of the coast valleys south of San Francisco, the weather is quite favorable to planting and growing crops, particularly the root crops. Especially is this true in the southern part of the State, and to greater or less extent in the districts near San Francisco. This part of the State is better and later supplied with rainfall in the spring. Under these conditions the beets germinate and grow to a considerable size before the cessation of rain. By the time the dry weather comes on the beet roots have gone down to considerable depth, reaching the strata moistened by subirrigation through natural drainage and seepage from the mountains. This carries the beets on to maturity.

While originally beet growing in these coast valleys was dependent exclusively on winter rains, the industry has been augmented in recent years to a considerable extent by irrigation. As a rule such irrigation is depended on to alleviate conditions in case of drought. Subdrainage of water from the mountains, through these valleys to the ocean, affords many opportunities for securing deep artesian wells. Many of these are utilized in irrigating lands.

The two new factories—one at Visalia, the other near Chico—are built in valleys on the east side of the Coast Range, depending generally on irrigation. They have conditions entirely different from those generally obtaining around the older factories. Chico is in the Sacramento River Valley, in Butte County, about 150 miles north of San Francisco. Visalia is about the same distance northwest from Los Angeles, in Tulare County. Both of these are in the inland basin between the Coast Range and the range of mountains east, into which comes the natural drainage from mountains on both sides, affording resources for irrigation. These valleys are very productive, especially the Sacramento Valley, in the northern part of the State, which covers a large area, upon which are grown the cereals, fruit, root, and hay crops. Throughout there are many of these inland districts, well watered and resourceful, capable of engaging in sugar-beet production. No doubt the work of these two factories will demonstrate its feasibility and lead to the construction in

the near future of many new factories in this interior part of the State. It appears probable several will be located in the Sacramento River Valley.

California has an extensive and rapidly growing fruit industry. Its distance from market makes preserving and canning, especially of the perishable varieties of fruit, desirable. In these processes sugar is used to a considerable extent. With the development of these industries the demand for sugar in the State is increasing at a rapid rate.

Sugar beets are known to be one of the best crops for rotation and soil improvement. Many of the valleys are devoted to growing small grain. It is found necessary occasionally to summer fallow the grain lands, cultivating down the weeds, and resting the land. By using sugar beets in rotation the same thing can be better accomplished, and an additional crop secured.

For growing beets conditions were very favorable in the State during the past season. To the beet-sugar industry it was the most profitable year of its history in the State.

Sugar production from beets in California does not represent nearly all of the finished sugar produced in the State. Located in California are two large sugar refineries, one being at San Francisco, under the direction of Mr. Claus Spreckels. For several years this plant has refined nearly the entire output of the raw sugar manufactured in Hawaii. The Hawaiian Islands manufacture at the present time about 450,000 tons of raw sugar, doing no refining. This is an amount in round numbers nearly equal to the entire production of beet sugar in the United States in 1906. Mr. Spreckels and those interested with him are also interested in several of the sugar factories in Hawaii and receive for refining their output of sugar. After being refined some of this sugar goes onto the coast markets in competition with beet sugar manufactured there. The rest of it is shipped east over the transcontinental railroads or by ship around the Horn. This sugar goes into the markets of the Mississippi Valley and farther east. In addition to refining the raw sugar of the factories in Hawaii, in which the Spreckels are interested, the management of the refinery has had an arrangement with the other factories of those islands for refining their output of sugar.

During the past year a large number of the sugar companies of the Hawaiian Islands entered into an arrangement with another sugar refinery and beet-sugar manufacturing company, whose plant is located at Crockett, Cal. It has been converted into a purely refining plant. Most of the sugar now produced in these islands is refined at this plant in competition with the one at San Francisco. This has necessitated importations of raw sugar by the San Francisco refinery from Cuba, Java, and other tropical countries, and has

added considerably to the output of sugar refined on the coast and to the amount of cane sugar entering our western markets in competition with beet sugar. The Crockett refinery is located on the San Francisco Bay, about 30 miles northeast of San Francisco, near Martinez.

Betteravia.—The plant located at this place, of 500 tons capacity, has been operating under the direction of the Union Sugar Company, which also controls the factory at Alvarado. The company had intended to increase the capacity of the plant during the past year by the installation of a new 750-ton diffusion battery. This machinery was at San Francisco at the time of the earthquake and fire and was more or less damaged. On account of delaying the adjustment of insurance the factory was compelled to start with the old battery.

From the beginning this factory has been one of the most successful operated in this State. Beets give good yields of excellent quality. Some of the beets grown for it are planted before the winter months; others are planted in succession during these months. This results in a greatly prolonged harvest or rather a succession of harvests. The management is able, as a rule, to secure all the contracts desired. On account of the large acreage planted and the long season for maturing beets, its campaigns are usually of considerable length.

The agricultural district surrounding the factory has a fine irrigation system, and most of the beets are grown under irrigation. The past season was most favorable. Results of the campaign are regarded as the best in the experience of the factory.

Chino.—The factory at Chino, operated by the American Beet-Sugar Company, has a capacity of 900 tons per day. It is located about 30 miles east of Los Angeles, in a fertile coast valley. The beets for it are grown both by irrigation and rainfall. It is the second oldest factory in the State. Conditions are well established and understood, and it usually has a sufficient supply of beets. It is gradually increasing the area of cultivated lands under irrigation. The yield and quality of beets are generally good. In the district some beets are planted as early as December, and most of the acreage is planted by the middle of March. In 1906 about 1,000 acres had been bunched and thinned by this date. Its campaigns usually open about the middle of July. The one just closed opened July 27 and proved to be one of the most satisfactory in the factory's history. Prior to its commencement many important improvements were made. Among others a new ice plant was installed, the diffusion battery was enlarged, and a new plant for lighting was installed.

When the factory is working at its full capacity it employs, skilled and unskilled, about 350 men. These are divided into two shifts, and the factory runs day and night seven days in the week.

HAMILTON.—A factory is located at this place of 1,000 tons capacity, operated by the Pacific Sugar Construction Company.

This district is in the northern part of California, on the Sacramento River, about 14 miles from Chico, and on the Southern Pacific Railroad. It was built last year and is the first plant installed in the fertile valleys of the Sacramento. It is anticipated that through the demonstrations of this one several others will follow in the valley.

This plant was built almost entirely with southern California capital. A number of the most influential and successful business men of Los Angeles and other points are interested parties. Ex-Senator Thomas R. Bard is its vice-president. Mr. Hamilton, of New York, who was for a number of years prominent in the operation of the American Sugar Company, was the prime mover in the establishment of a factory at this place. The company bought about 10,000 acres in Glenn and Butte counties. These lands are located along the Sacramento River. A new town was established at this place and is building up very fast. It is the purpose of this company to devote the entire area of its cultivated lands to growing sugar beets and other necessary crops in rotation. The tract is to be divided up into 25-acre lots, upon each of which will be placed a tenant engaged in the production of sugar beets. A number of settlers were brought in for this purpose, mostly of German extraction. Quite a number of Japanese were also brought in, and the lands were leased to them.

This company has installed almost everything in the way of improved modern equipment. It has built a fine irrigation system, put in an electric pumping plant on the banks of the Sacramento, established electric car lines penetrating its beet-growing district and connecting with other towns. It is building extensive cattle yards, in which it proposes to feed the pulp from the factory. It is introducing the most modern agricultural implements, among others the gang plow.

This being the first year of the factory's operation, and pioneer work being necessary to develop conditions for producing the beets, the tonnage was not as large as the factory will regularly require. Indications point to a much larger tonnage next year and a more rapid and higher development of the agricultural conditions.

The tonnage was reduced on account of the San Francisco fire burning the pumps which were intended for use in irrigation. This interfered with irrigation at the proper time and resulted seriously to beet growing. None of the farmers were accustomed to beet culture, and it was difficult to persuade them to give the proper care to the crop. The army worm interfered considerably, stripping the beets of foliage and also affecting the sugar contents and purity. Nevertheless, beets ran as high as 24 per cent of sugar and 89 in

purity. Some land, properly taken care of, produced as high as 28 tons per acre. The company is introducing alfalfa, sowing this year about 600 acres to feed with the pulp.

Under the conditions existing in this district beets can be planted from December 15 to April 15, giving it a long season for planting and producing beets, thus extending the campaign of the sugar factory.

Los Alamitos.—A factory of 700 tons capacity is operated at this place by the Los Alamitos Sugar Company. It is about 20 miles south of Los Angeles, near the ocean. Beets are grown both by irrigation and rainfall. For the first few years upon rainfall depended the entire crop of beets for the factory. More recently artesian wells have been sunk; also there are better assurances of beet production under dry conditions. The winter rains were abundant for planting and growing beets, and much of the area was planted as early as December.

In the Los Alamitos district the winter months were quite damp. In November, 4.48 inches of rain fell. December was comparatively dry, having 0.12 inch of rainfall. This allowed the farmers to get their land in good shape for seed bed. January had a rainfall of 2.57 inches; February, 2.24 inches. Most of the planting was done during this month and the first part of March, which was a wet month, with 5.46 inches of rain; but April had only 0.51 inch. May was fair, with a rainfall of 1.17 inches on the 26th and 27th. This rain injured the crop considerably, as the ground was already wet enough. It caused the beets to keep their roots near the top of the ground, resulting in light tonnage. In June were some very hot days, interspersed with others which were cool and foggy. The damp cool weather produced tops very rank and tender, and about the middle of the month three very hot days "cooked" the foliage to such an extent that the beets did not recover readily. This, with the late rain in May, reduced the crop about 20,000 tons below the yield anticipated from the experience of previous seasons.

The campaign was prolonged about fifteen days on account of lack of cars to supply sufficient limestone for daily requirements. The railroad failed to furnish sufficient cars.

During the early summer, before commencing the campaign, many improvements were made on the factory. Oil is used for fuel. The factory now disposes of its pulp, though at its beginning this was almost an entire loss. Pulp feeding has become quite general among the farmers throughout the district, which is developing considerable feeding and dairying.

The quality of the beets grown in this district, as shown year after year, is better than at any other place in the United States.

Below I clip a statement made by the Anaheim Gazette, a local newspaper, giving the average sugar contents and purity of beets for twelve consecutive days ending August 18:

Sugar contents and purity of beets at Los Alamitos, Cal., August 6–18, 1906.

Date.	Percentage of sugar.	Purity coefficient.	Date.	Percentage of sugar.	Purity coefficient.
August 6	21.68	82.8	August 13	19.95	81.5
August 7	20.79	81.8	August 14	20.27	82.3
August 8	19.62	81.2	August 15	19.46	82.5
August 9	19.45	81.7	August 16	19.15	81.8
August 10	19.62	81.8	August 17	18.55	81.4
August 11	19.52	81.2	August 18	18.89	81.6

We often find individual beets running as high as those shown in the above table; but as these are averages for daily runs of all beets sliced in the factory the showing is simply remarkable, though it accords with usual results of the district.

Oxnard.—A plant of 2,000 tons capacity has been operated at this place by the American Beet Sugar Company for several years. It is a model of sugar production in California. Although of unusual capacity, it generally has long campaigns. Beets in the district run very high in sugar.

The factory is equipped with almost everything modern in the way of appliances and facilities for a sugar factory. It also utilizes to the best advantage all the secondary features incident to the sugar industry. For instance, it has established numerous feeding pens, from which are annually fed large bunches of cattle. For this purpose it consumes pulp extensively. Local farmers and dairymen generally use pulp. The company has considerable land of its own. It carries on extensive experiments for the benefit of general beet production. Its cattle graze in the beet fields, consuming the tops and leaves after beets are harvested. In addition, they are systematically fed on a ration containing pulp.

Twenty years ago there was very little agricultural development in this district. The cultivated arable lands in use were usually planted to small grains, and the yield was small and general results not very satisfactory. The bean crop is extensively produced in the county, and in recent years has yielded increased profits.

Eight years ago this sugar factory was built. The inspiration given to the whole district has been something remarkable. At the time the factory was built its location was simply a small town where hay and beans were delivered, and, to some extent, fruit. To-day it is a well-built town of 3,500 inhabitants, business is prosperous, and in comparison with other towns of the State it ranks very high as a business point. At the time lands were devoted to hay, beans, and

the cereals, they were worth, at the outside, less than $50 an acre. Now lands in that district are worth from $250 to $400 an acre. It is not probable that there would be many acres on the market even at those figures. Farmers growing beets for this factory get, on an average, $40 to $50 net returns per acre. This would give the average acre a net earning power of 10 per cent if valued at $400 to $500.

With the rest of the factories of southern California the district enjoyed a bountiful rainfall during the winter, lasting up through May and into July. The yield of beets was large and the quality excellent.

Spreckels.—A beet-sugar factory of 3,000 tons capacity is operated at this place by the Spreckels Sugar Company. The location is a little town known as Spreckels. This is near the town of Salinas, about 118 miles down the coast from San Francisco.

Beets are grown in a large fertile valley. Every year a large tonnage is secured. While the new factories building and those making enlargements in the State were affected by the recent earthquake, which damaged machinery on the road, the factory at Spreckels was itself seriously damaged by this disturbance. Extensive repairs were necessitated to put it in readiness for the campaign. The season was quite favorable with the exception of floods in May, which washed out some of the beets and made replanting necessary.

Visalia.—A factory of 350 tons capacity was operated here this year for the first time by the Pacific Sugar Company. Beets were planted, in about even proportions, in January, February, and March. Considerable of the land was broken up by the aid of a traction plow turning over 40 acres per day.

The season was quite favorable, and considering the newness of the district in growing sugar beets, a good yield and quality of beets was secured where farmers gave heed to the directions of the agricultural superintendent.

Some damage was done to machinery in transit by the earthquake at San Francisco.

It is the purpose of the management of the factory to try the availability of a large traction engine for beet delivery. Experiments indicated that this might be desirable with the roads in fine condition.

On account of the very early planting of some of the beets and the lateness of starting the campaign, many of the beets became too ripe and stayed in the ground too long, lowering the purity and causing considerable loss of beets. As a rule, beets marketed and tested at the proper times indicated high quality, purity, and a good yield.

On account of the newness of the district and the misfortunes met by the factory, it was required to close down on several occasions, thus extending the time of the campaign. The district had consider-

able difficulty in securing labor, both in the field and factory. These are things often encountered by new factories, and as a rule they are remedied by the beginning of the second campaign.

COLORADO.

One of the most interesting States engaging in the beet-sugar industry is Colorado. Here the influence of this industry in developing the resources of a State can be studied better than in any other place in our country. From its inception improvement has been very rapid; progress and development of business interests has been incessant. In most instances factories have been located in small towns. The upbuilding of business at these centers has been remarkable.

In all parts of the State where crops are grown irrigation is necessary. Draining the Rocky Mountains toward the east are two rivers—the Platte and, farther south, the Arkansas. In Colorado along the Platte River, from which beets and other crops are irrigated, are located 9 sugar factories. Along the Arkansas River there are 5. The results of these factories have been something remarkable, not only in the production of sugar, but in the general development of agriculture and business.

In the western part of the State is the Grand River, flowing westward. Upon this, in Mesa County, is located the sugar factory at Grand Junction, and beets grown for this factory are irrigated from it. Near the Platte River and near together, in the western part of Weld County, are 3 large sugar factories—at Greeley, Eaton, and New Windsor. In the eastern part of Larimer County, adjoining Weld, are 2 sugar factories—at Fort Collins and Loveland, respectively. Near these factories, in the northeast corner of Boulder County, is another sugar factory—at Longmont. Thus we find a group of factories around the one at New Windsor at distances ranging from 12 to 25 miles. These factories are all substantially built, modern, and equipped with the best machinery.

In this district are a great many reservoir lakes, which are filled in the spring from the melting snows in the Rockies. They are used for storage of water for use on crops during the growing months.

In rotation with sugar beets are grown wheat, potatoes, alfalfa, barley, and some other crops. The soil is very productive of any of these, and good lands are worth from $150 to $300 per acre. The towns at which these factories are located are now all live, up-to-date, active business centers. The amount of money annually pouring into these localities so near together gives to this part of the State a very prosperous and interesting aspect.

Eighty miles east of Greeley, along the Platte River, is located, at Fort Morgan, another sugar factory, and on the same river, 12

miles farther east, is located a factory at Brush, both of these being in Morgan County. About 50 miles farther east, on the Platte River, is another factory at Sterling, completing the present system of sugar factories on the Platte River.

On the Arkansas River, at Rocky Ford, in Otero County, is located one of the largest and the second factory built in the State. About 5 miles east of Rocky Ford, at Swink, in Otero County, is another sugar factory. About 17 miles north, on the Missouri Pacific, in Otero County, is the Sugar City factory. About 50 miles east of Swink, on the Arkansas River, is a factory at Lamar, and 30 miles east of that, on the eastern edge of the State, on the Arkansas River, is a factory at Holly. Both the last-named factories are in Prowers County. This completes the Arkansas River factory system.

This gives the State of Colorado 15 sugar factories. No other industry has done so much to develop its agricultural resources. It is estimated that during the last year these beet districts in Colorado produced nearly 1,500,000 tons of beets, worth $7,500,000. They have been the direct cause of building several local transportation lines reaching out into the agricultural districts, hauling the sugar beets to the factory and other products to the main lines.

Their influence on the live-stock industry has been marked. Alfalfa, small grain, and the pulp from the sugar factories make a ration adapted to fattening cattle and to feeding dairy animals. When the State of Colorado first engaged in beet-sugar production it had very little information regarding methods and utilities incident to the beet crop. At first very little use was made of the by-products. Most of the pulp and molasses were thrown away. Now the pulp is contracted for in advance of its production at 50 cents per ton. Arrangements are under way for establishing a distilling plant to produce denatured alcohol from the waste molasses.

Outside the general demand from large feeding interests in these factory districts, the factories themselves have built extensive feeding pens for fattening large bunches of cattle and sheep. In the area tributary to the six factories in Weld, Larimer, and Boulder counties several hundred thousand lambs are annually fattened by the feeders and factory managements. According to the estimated production of beets in Colorado for 1906 the output of pulp would be 750,000 tons. This, valued at 50 cents per ton, the regular market price, would equal $375,000.

For a few years these factory managements had difficulty in securing sufficient beets to run full campaigns. This is now changed. Beet production has become so popular that the serious problem during the past season was to dispose of all the beets presented. Even at the rapid rate factory building has proceeded in the State it has outstripped the State's capacity for manufacturing sugar. When the

first factory was built at Grand Junction the difficulty of securing sufficient beets to run the factory became so intense that it was necessary to close it for a couple of years. This year this factory had as many beets as it could practically work. How to utilize the beet-producing area developed is becoming a serious problem with most of the factories. Now that the farmers are better advised on beet production and realize more fully the benefits of the sugar factory and crop, the tendency in beet districts is to overproduction. The factory managements realize this and appreciate the necessity of more plants. At the present time there are some economic conditions causing capital to hesitate about making such large investments as are required by sugar factories. The beet growers seem prepared to furnish beets in abundance to meet the demands of a very rapid increase in factory building.

For some time the price of beets has been $5 per ton flat. At the close of the 1906 campaign the Great Western Sugar Company proposed a new conditional two-clause elective contract. This provided that—

First. The farmer could elect to deliver all his beets as soon as harvested, for which he would be paid $4.75 per ton flat.

Second. He could elect to silo one-fourth of his crop and deliver the rest as soon as harvested. For the part delivered immediately he would receive $5 per ton flat, for the part siloed and delivered in winter he would receive $5.50 per ton flat.

Beet deliveries at most of these factories have been so large, so much beyond their storage capacities, that a great deal of difficulty has been encountered. It became necessary to pile the beets in heaps on the factory grounds and along the railroads in the country. Before these beets could be reached they were frozen, many of them thawed, and considerable loss was incurred in inversion of sugar and rotting of the beets.

This company, operating these 9 factories in Colorado, in offering this contract hoped to induce the farmers to silo a large portion of their beets, delivering them later, thus facilitating the operations of the plant and preserving the quality of the beets. In the northern part of the State the beet growers have organized a State beet growers' association. Through this association they are asking a flat price of $5 per ton and no siloing.

One of the bad effects of overproduction manifested itself this year. Near the middle of November occurred a very heavy storm, accompanied with snow and freezing. From 12 to 20 per cent of the beets grown for these factories were still in the ground. Quite large quantities of the beets had been harvested and were in piles in the fields, simply covered with beet leaves. These were frozen as

they lay. The factories engaged at once in working these, as beets are not damaged if they are worked before thawing. The hazard lay in the beets still in the ground. It is impossible to harvest beets when the ground is badly frozen, and if it remains permanently frozen the beets are lost. It is impossible for a factory to receive at once and store all of the beets grown for it. Most companies insist, before time for the ground to freeze, that beets not needed for the factory's run for a certain period shall be harvested and siloed, and in Colorado they offer 50 cents per ton extra for siloing. The Northern Beet Growers' Association, on the other hand, strongly objects to this extra work. With reference to this point there has been considerable negotiations between the two interests. In preference to a price based upon the sugar content and purity, the association further asks for a straight flat rate of $5 per ton. Undoubtedly these matters of controversy will eventually be amicably settled.

It may be said that the favorableness of the season, the better methods, and the past profits conspired to make the past year a record breaker in beet growing in Colorado. Nowhere was there heard any expressed regrets of factory managements on the lack of beets. Overproduction was the more familiar expression. The yield was very high and sugar contents and purity were excellent. In 1906 the sugar industry brought prosperity to everybody engaged in it.

Brush.—The Great Western Sugar Company operated a factory of 750 tons capacity during its first campaign this year. Beets grown for it were of good quality, and farmers as a rule secured good yields. Beets have been grown around this place to a considerable extent for several years. The factory was necessary to meet the demands of rapidly growing beet production.

Eaton.—A factory of 600 tons capacity has been operated by the Great Western Sugar Company at this place for several years. Prior to beet growing the district was largely given to the production of potatoes and wheat. This factory is near to and associated with a number of others in that part of the State. In this district it may be said that beets are the leading agricultural product. The season was quite favorable. A large acreage was planted for the factory. It had an abundance of beets, and made a full campaign.

Fort Collins.—The Great Western Sugar Company is operating a factory at this place of 1,200 tons capacity. Weather conditions were favorable the past year, and farmers have become familiar with the crop. The large acreage planted resulted in what is generally called a "bumper" crop. Shortage of cars very much delayed the delivery of this large tonnage of beets. This was followed during the harvest by a serious snowstorm, lasting several days, freezing

many of the beets in the ground. All of this caused much inconvenience and considerable loss both to the farmers and factory management. It is from this district in Colorado the most serious objections to siloing come.

Throughout the district the yield of beets per acre was very large and the quality exceptionally good. The better qualification of the farmer to produce sugar beets in the older factory districts is the principal factor to which is due the increase in acreage and in yield per acre. He knows the soil requirements, the better methods of culture, and how to handle and economize labor. He gets better results and it costs him less, all of which tends to encourage him to produce the beets.

As an indication of the situation at Fort Collins this year, the results of beet growing, and the public's appreciation, I clip from the Denver Republican of December 18, 1906, the following:

Since December 1 the Fort Collins sugar factory has paid out for sugar beets and for salaries and wages of employees over $400,000, and since the sugar campaign opened, on September 25, over $800,000. Another payment of beets will fall due January 15, when it is expected $200,000 more will be paid out, making over $1,000,000 which the factory will have put into circulation by that time.

There are yet at least 40,000 tons of beets at the various dumps and in the fields to be delivered to the factory and the sugar-making campaign will probably not end before March 1.

Chester Iddings, one of the successful farmers of the Cache La Poudre Valley, last spring planted 84 acres to sugar beets. He harvested his crop, 1,800 tons, and had it all delivered before December 1, and December 15 received a check for $9,000. His beets averaged 21.4 tons to the acre. Deducting $3,000 as the cost of producing the crop, he has $6,000 profit.

Larimer County, in which Fort Collins is located, is in one of the best developed agricultural sections of the State. In this county are two sugar factories, the other one being located at Loveland. I clip from the Fort Collins Express the following statement of crops produced, with their respective values:

Values of agricultural products of Larimer County, Colo.

Beets	$1,796,270
Wheat	360,000
Oats	98,000
Alfalfa	500,000
Berries	150,000
Fruits	75,000
Potatoes	125,000
Lamb feeding profit	225,000
Cattle profit	100,000
Total	3,429,270

Fort Morgan.—This season for the first time the Great Western Sugar Company operated a factory of 600 tons capacity at this place. As is usually the case when factories operate the year they are built, it was late in beginning its campaign, the opening in this case being on December 15. Many of the beets grown here were shipped to the factories at Brush and Sterling. The acreage planted was 4,343. An excellent stand was secured. As in other districts in the State the season was very favorable, the yields ordinarily running from 15 to 25 tons per acre. The beets were of high quality. It may be said, considering this to be the first year, that the results of beet growing were exceptionally good.

On account of the delay in completing the factory the farmers were late with their harvest, and the storm and freezing spell caught more beets in the ground at this place than in any other district in the State.

Grand Junction.—The Western Sugar and Land Company is operating a factory here of 500 tons daily capacity. The past season's results of this factory are the best illustration of snatching success from absolute failure.

The first two years this factory operated, its campaigns were very short, the beets were of ordinary quality, and the yield was poor. It closed down for a couple of years. It was reorganized under a new management and operated under an entirely different plan. In order to insure itself a sufficient acreage of beets the company bought a large acreage of land. On this land beet growing was made the principal feature. It branched out to other towns in the Mesa Valley and secured contracts. About 5,000 acres were planted last spring. The season was exceptionally good and the results were very favorable to everybody concerned. This may be regarded the best year in the experience of this factory. With the farmers beet growing has become popular. Feeders consume all the pulp. The future of the factory is assured.

Greeley.—The Great Western Sugar Company has been operating a factory of 800 tons capacity at this place for some time. In results of making sugar and growing beets this is one of the model beet-sugar plants in the State. The company secured a large beet acreage. On account of its capacity limit it was compelled to refuse contracts with a number of farmers. The tonnage produced was several thousand in excess of what the plant could use, and these were shipped to other factories near by. On account of the large supply of beets at its disposal the factory opened its campaign early—September 14. At this date the quality of the early beets was not excellent.

The factory at Greeley is near two other sugar factories in the same county—at Eaton and New Windsor, respectively.

From the Denver (Colo.) News of November 25, 1906, I take a brief summary of conditions in the section of the country where these sugar factories are located:

> If the total crop is harvested, there will be paid out for beets at the Greeley, Eaton, and Windsor factories not less than $1,500,000, and an additional $250,000 for labor in the factories proper, not including about $400,000 paid out to beet tenders during the summer. This will mean a total of $2,150,000 distributed among the farmers and workingmen of the three towns during this campaign.

Holly.—The Holly Sugar Company operated a sugar factory here of 600 tons capacity. It is located in Prowers County, in the Arkansas Valley, near the eastern line of Colorado.

For several years a large acreage of beets has been grown here for the factory at Rocky Ford. The latter has so stimulated beet growing in the Arkansas Valley that three other factories have been constructed to take care of the supply of beets.

Six thousand acres of beets were planted. A good stand was secured. Taking everything into consideration the season was favorable. The yield and quality of the beets were excellent.

Lamar.—The American Beet Sugar Company is operating a factory here of 400 tons capacity. This district has been growing beets for some time for the factory at Rocky Ford. The farming community began producing beets for this factory with practical experience.

Operated by the present owners, the machinery of this factory was formerly in the plant at Norfolk, Nebr.

Weather conditions in this district were ideal throughout the growing period of the beets. Delivery of beets was considerably impeded later on account of the snowstorms and freezing conditions prevalent throughout the State about the middle of November. The campaign opened September 24. The quality of the beets was fair, and the yield unusually good. A large acreage was planted. The plant secured sufficient beets to give it a long campaign.

Longmont.—The Great Western Sugar Company operates the factory here. The accredited capacity per diem of this factory is 1,200 tons. Through recent improvements it usually exceeds this by 150 to 300 tons.

In common with the rest of the northern Colorado districts, it experienced a very favorable season and 11,800 acres of beets were planted. The results of the harvest in the district show an average of 14 to 15 tons per acre, giving the factory a long campaign. At the time of the heavy snow and freeze—the middle of November—this district had about 10,000 tons of beets in the ground and 30,000 lying in piles undelivered.

To facilitate beet delivery a railroad has been built from Johnstown, Weld County, to Longmont. This gives the district excep-

tional facilities for shipping by rail. Its beet-growing area is now well supplied with railroad transportation facilities.

There are now fattening on the ground around this sugar factory 50,000 head of cattle and sheep.

This place affords a study of the revival of business of a community by the introduction of a sugar factory. When built, Longmont was an ordinary quiet town, without much business activity. In order to indicate the change in land values and business, I clip from the Boulder (Colo.) Cambra of Friday, December 7, the following statement:

> One million dollars is a low estimate of the money added to the wealth of Longmont annually by the establishment of the sugar factory. This immense sum goes into every avenue of trade and business, and every man, woman, and child is a beneficiary.
>
> The going wage for man with team and wagon is $6, and as high as $10 has been paid per diem.
>
> As an instance of the increase in land valuation, we may cite the following: A short time before the building of the sugar factory a quarter section of land near Longmont was sold for $60 an acre, on easy time payments—in fact, the land had gone begging for a purchaser. Within one year the entire tract changed hands at $125 per acre. In six months more 80 acres were sold at $250 per acre, and the balance in smaller tracts at $250 to $300 per acre. In another case 4,000 acres previously held at $40 per acre are valued to-day at $150 to $200, according to quality.

Loveland.—The Great Western Sugar Company is operating a factory at this place of 1,200 tons capacity. It was the first one built in the northern part of Colorado. It may be called the mother plant of the other 9 along the Platte River. From the beginning beet growing has proven profitable. Throughout its career it has received annually a sufficient supply of beets to maintain satisfactory campaigns.

As a part of the plant, railroads have been added penetrating a large beet-growing area. These are operated for the special purposes of this sugar plant, delivering to it raw material and carrying the finished product to the market. Probably no other sugar-producing plant in the United States has had a more continuously successful history than this one. For several years the district has produced considerably more beets than necessary for this plant. These have been shipped to other factories belonging to the company in the vicinity. At the time of the November storm the freeze caught about 25,000 tons in the ground, and the same amount harvested, piled on the ground, and lightly covered. For this factory about 15,000 acres were planted. On the whole, the season was considered favorable, the average yield being between 14 and 15 tons per acre and the beets running from 14 to 20 per cent of sugar.

New Windsor.—The Great Western Sugar Company is operating a factory here of 600 tons capacity. The district experienced the same generally favorable season as the other factories in northern Colorado, and produced a large tonnage.

One of the features of this factory is that most of the beets are hauled to the factory by wagon. Consequently it was not subject to the inconvenience occasioned by the dearth of cars at the time of the beet delivery.

Pulp is worth at this factory 50 cents a ton, and sheep and cattle are fed in the vicinity.

Laborers in the field are generally of German and Russian extraction, many of these renting small tracts for growing beets. Where the hand labor is contracted by the acre the usual price for weeding, bunching, thinning, hoeing, and hand work in the harvest is $20.

Rocky Ford.—The American Beet Sugar Company has been operating at this place a factory with a capacity of 1,000 tons per day. The lands producing the beets are watered by irrigation from the Arkansas River. As a rule sufficient rain falls in the winter and spring to germinate the seed and start the beets to growing. The soil in this district is very productive. The principal crops are sugar beets, alfalfa, and melons. This is the home of the famous Rocky Ford cantaloupe. These are grown here, crated, and shipped to all parts of the country. The district has also developed a large industry in producing a high quality of melon seeds. The flavor and sweetness of the melons are known throughout the country. The beets produced are of the same high quality.

Good lands are worth from $150 to $300 per acre, depending upon their location and distance from shipping.

The season throughout was unusually favorable. The rainfall at the time of harvest was more than ordinary. This had a tendency to lower the quality of the beets worked in the early part of the campaign. Like Loveland, in the North, this factory in the South, on the Arkansas River, is the progenitor of the others along its course which have been installed to work the beets grown.

Sterling.—The Great Western Sugar Company is operating a factory here of 600 tons daily capacity. The season was unusually favorable. About 6,500 acres were planted. It is estimated that Sterling district produced 65,000 tons of beets, requiring a campaign of about four months. On account of lateness in completing the plant at Fort Morgan, a large tonnage was shipped from that point to Sterling for manufacture. This materially increased the length of the campaign of this plant. It is estimated that about 80,000 tons of beets were worked altogether.

Sugar City.—The National Sugar Manufacturing Company is operating a factory of 500 tons capacity at this point. Beets are

grown on lands irrigated from the Arkansas River. The company has a ditch about 40 miles long connecting with that stream. This carries the water into a couple of natural lakes on the company's ground. These are used for storage. The acreage contracted for was 6,159. The season was favorable. Beet growing was unusually successful. This company owns about 12,000 acres of land. It feeds cattle extensively on a ration of pulp and alfalfa.

SWINK.—The Holly Construction Company operated a factory of 1,200 tons capacity at this place for the first time this year. It is located on the Arkansas River a few miles east of Rocky Ford. Its establishment resulted from the large area worked up in growing beets by the factory at Rocky Ford. It is estimated that 8,220 acres were planted. The rainfall was sufficient to germinate the beet seed and start the plants to a healthful growth. The season throughout was favorable.

IDAHO.

Idaho is rapidly developing its agricultural resources. For several years in my annual reports I have been calling attention to its natural adaptation to agricultural industry. Primarily its soil is very fertile. It sustains a large crop list. It has an excellent climate, and vegetation grows thriftily and is usually of splendid quality. Most of the deciduous fruits produce in this State bountifully. It is especially adapted to high-grade apples and pears. Fruit takes on a rich coloring and a fine flavor.

As in the State of Colorado, cropping is dependent largely upon irrigation. Flowing through the State of Idaho from east to west and, to a considerable extent, up its western border is the great Snake River. Along the borders of this river are some very beautiful fertile valleys. It passes across the lower quarter of the State in the form of a crescent, with the bow to the south. It then passes up the western border for a considerable distance. The principal railroads follow this water course. There are other short stub lines reaching out from it either way, tapping rich agricultural districts. Running into this river, draining the mountains of its central area, are a number of other streams, the whole forming a system from which an abundance of water can be supplied for irrigating large tracts of land. For several years the various interests of the State and writers for the press have been calling attention to the State's natural agricultural resources.

Four years ago a sugar factory was introduced in the eastern part of the State, at Idaho Falls, on Snake River. This was the signal for a rapid development along the entire length. Many schemes of irrigation and internal improvement looking to facilities for utilization of the soil in crop production began to materialize. Tests made

in the State by those interested in the sugar industry revealed wonderful capabilities.

Not far north from this another factory was soon built, near St. Anthony, in Fremont County, at a small point called "Sugar." The year after this another one was started—a near neighbor of the first—at Blackfoot, in the same county, Bingham. Last year a factory was built at Nampa, in Canyon County, near the western border of the State. At the time this factory was established the sugar company agreed to build another at Payette, on the Snake River, in the northern and western part of Canyon County. So rapidly has beet growing developed in this district that this locality is now ready to furnish the acreage, and it seems settled that a factory will be erected at this place in 1907 or 1908. It may be said that there is hardly a well-developed agricultural district in the State that is not being considered for future beet-sugar production.

Since the inauguration of the sugar industry, development of irrigation and transportation facilities has followed in the State very rapidly. Around it hinges most of the plans which are materializing such effective and rapid results in the State. Since the building of the sugar plant at Nampa, which is located near Boise, the rapid development taking place in the territory represented by these towns has attracted the attention of the Reclamation Service of the Department of the Interior. It is now constructing what is known as the Boise-Payette irrigation project, at a cost of $7,000,000. When this project is completed it will water 300,000 acres of fertile land. Before it was started a large part of the area to be covered by its ditches was simply desert, upon which nothing grew but the sagebrush and kindred plants. With the prospects in view settlers are pouring into that section and rapidly developing all kinds of business. By the time the Government ditch is completed it will be one of the most closely settled, active agricultural districts in the State.

For years this State has sustained on its range millions of sheep, cattle, and horses. With the building of the ditch and the development of cultivated lands growing alfalfa and small grain, this stock is now being fed for market in the neighborhood of the sugar factories upon these home-grown feeds, mixed with a ration of pulp. It may be said that in the four years, from simply a stock-range State, Idaho has developed conditions sustaining all the features of animal industry from breeding to finishing for market.

All this State has ever needed to bring about this condition is irrigation. Water it had in abundance, flowing down its streams from the snows collected in winter and melting in summer. It has needed some stimulus to bring together the capital and business talent for installing irrigation systems. The instrumentality which has

largely accomplished this is the sugar factory. The State of Idaho is fast taking its proper place as an agricultural State.

It may be said that beet-sugar production in Idaho is entirely due to results of this industry in Utah, as all of the sugar factories operating in that State are under the management of the two companies operating factories in Utah.

The Deseret News (Salt Lake City) of December 15, from data obtained from the sugar companies, published a summary presenting the status of the beet-sugar industry in the State of Idaho. Coming from this paper it carries more than usual authority, and it is based largely upon actual, rather than estimated, results for 1906. It gives an idea of the importance this industry is assuming in that State. The estimate follows:

General results of the beet-sugar industry in Idaho in 1906.

Total acreage	acres	20,000
Total tonnage	tons	230,000
Average yield per acre	do	11.14
Total capital invested		$4,500,000
Total money paid farmers for beets		$1,100,000
Total money paid factory labor		$260,000
Output of sugar. (See table below)	pounds	64,000,000
Value of refined sugar, at 4½ cents per pound		$2,880,000

Estimated results of operation of Idaho factories in 1906.

Name and location.	Estimated product of sugar.	Estimated length of campaign.	Number of factory employees.	Number of farmers growing beets.
	Pounds.	*Days.*		
The Idaho Sugar Company, Sugar City	23,000,000	115	200	500
The Idaho Sugar Company, Idaho Falls	20,000,000	90	160	450
Snake River Beet Sugar Company, Blackfoot[a]	10,000,000	85	140	200
Western Idaho Sugar Company, Nampa	11,000,000	75	160	300
Total	64,000,000	.....	660	1,450

[a] The Blackfoot factory will work about 15,000 tons of beets diverted from the Sugar City and Idaho Falls plants.

The last session of the National Irrigation Congress was held at Boise, Idaho, September 3 to 8, 1906. One of the chief features of interest at this meeting was a sugar-beet prize contest. The Great Western Sugar Company, of Denver, Colo., operating 9 factories, offered a prize costing $500 to the beet grower presenting the highest grade beets. The date of this contest was a little early for beets grown in the intermountain States, from which most of the samples came. It may be stated, however, that all the samples presented, considering the time, indicated very high quality. The contest was open to individuals, firms, corporations, organizations, counties, and States.

Regarding the results of this contest, M. B. Gwinn, of Boise, Idaho, has the following to say:

BOISE, IDAHO, *January 7, 1907.*

DEAR SIR: I inclose you herewith a copy of the report made by the chemists and the committee making the awards, which I trust contains the information desired.

The loving cup donation by the Great Western Sugar Company was awarded to the State of Idaho on the beets raised and exhibited by Mr. C. Nofsinger, of Nampa, Idaho.

Very truly, yours, M. B. GWINN.

The following are the rules governing the contest:

The samples shall consist of 5 beets of an average weight of not less than 1 pound each, not more than 4 pounds each, accompanied by tag giving name and address of grower and kinds of seed, also date of planting (if possible).

The samples of beets examined by the judges shall be turned over to the chemists for analysis after the judges have recorded in a book the names and addresses of the growers, giving each sample a number, which shall be entered in the judges' book as a record. The chemists, after determining the percentage of sugar and the purity of each sample, using the methods employed by first-class sugar factories, shall record the result on a field sample slip, attaching the same to the grower's sample slip, and shall record the results on a field laboratory sheet, giving name of grower, the date of sample, the average weight, the brix per cent sugar in the juice, the per cent of sugar in the beet, the purity, and any other information that may be found upon the grower's sample slip or otherwise discovered by the chemist, and shall return the slips, together with the report sheets, to the judges, furnishing duplicate sheets containing the above information to the board of control immediately after the completion of the work.

The basis upon which the prize shall be awarded is as follows:

	Points.
For perfection in shape, not to exceed	10
For 14 per cent of sugar in the beet	25
For every additional 1 per cent of sugar (with a proportionate amount for every fraction thereof)	4
For a purity of 80	25
For every additional point of purity (with a proportionate amount for every fraction thereof)	3

In the table below will be found the names of the exhibitors, the number designating each, the weight, the brix degrees, polarization of sugar in the juice, purity coefficients of the beets, and grade number designating form.

List of analyses covering beet exhibit at the Boise Irrigation Congress, 1906.

Name.	Record No.	Weight.	° Brix.	Polarization.	Per cent of sugar.	Coefficient of purity.	Form.	District.
		Lbs. ozs.						
Gibson & Hunt	10	2- 3	18.7	15.9	14.7	85.0	9.0	Nyssa, Oreg.
A. J. Quackenbush	11	1-12	17.8	14.6	13.5	82.0	7.25	Ontario, Oreg.
R. Mulder	12	2- 0	19.5	16.6	15.4	85.1	7.5	Do.
James Walters	13	2- 2	17.6	15.0	13.9	87.0	7.5	Do.
F. W. Sheffield	14	2- 8	19.5	16.2	15.0	82.8	8.0	Nyssa, Oreg.
K. S. & D. Ranch	16	2- 5	17.3	13.7	12.7	79.2	7.0	Ontario, Oreg.
C. E. Annidon	17	1-15	18.2	15.8	14.6	86.8	7.5	Do.
C. J. Beckwith	18	3- 3	21.4	18.6	17.2	86.7	8.0	Payette, Idaho.
Geo. Mordhurst	19	2- 9	19.1	14.5	13.4	75.7	8 33	Do.
Peter Pierce	20	3- 4	19.1	16.3	15.1	85.4	7.5	Do.
E. C. Brainard	21	2- 8	19.1	16.0	14.8	83.8	8.33	Do.
H. N. Lewis & Son	22	3- 1	19.3	16.4	15.2	84 9	7.25	Do.
J. A. White	23	2-11	19.1	16.3	15.1	85.1	9.0	Do.
John Barch	24	2-15	18.8	15.9	14.7	84.3	8.0	Do.
C. C. Eiffe	25	2-12	19.0	15.9	14.7	83.7	7.0	Do.
A. L. Tuttle	26	2-11	19.8	16.5	15.3	83 3	7.5	Do.
James Hutchinson	27	2- 5	21.0	17.8	16 5	84.8	7.25	Do.
Henry Irvin	28	2- 2	21.0	18.1	16.7	86.0	8.0	Do.
E. Bloomstrom	29	3- 5	19.7	17.0	15.7	86.3	7.25	Do.
Frank Roberts	30	3-11	18.3	15.1	14.0	82.1	9.0	Do.
C. E. Harry	31	2- 4	20.3	17.2	15.9	84.7	7.0	Do.

List of analyses covering beet exhibit at the Boise Irrigation Congress, 1906—Continued.

Name.	Record No.	Weight.	° Brix.	Polarization.	Per cent of sugar.	Coefficient of purity.	Form.	District.
		Lbs. ozs.						
McOmie & Albert	32	2- 1	19.4	16.0	14.8	82.5	7.0	Payette, Idaho.
W. McConnell	33	3- 3	18.7	15.0	13.9	80.2	6.75	Do.
H. C. Precht	34	1- 6	19.4	16.5	15.3	85.0	6.75	Do.
H. Cornulson	35	2-12	19.2	16.2	15.0	84.4	6.25	Do.
B. H. Woods	37	3- 0	18.3	15.3	15.1	83.3	7.25	Do.
Wm. Winters	38	1-13	18.4	15.2	14.1	82.6	7.0	Do.
John Anderson	39	2- 1	21.0	18.1	16.7	86.2	8.0	Do.
Jesse Graham	40	1-13	20.7	17.3	16.0	83.3	8.0	Do.
O. H. Bushnell	41	1-14	20.9	18.0	16.7	86.1	7.5	Do.
E. E. Hunter	42	1-13	19.4	16.8	15.5	86.3	8.5	Do.
L. Johnson	43	2-12	17.5	14.7	13.6	84.0	8.25	Do.
B. Shontz	44	2- 5	21.8	17.7	16.4	81.2	7.0	Do.
Guy Graham	45	2- 5	21.7	18.5	17.1	85.3	7.25	Do.
J. Bowers	46	2- 5	18.6	15.7	14.5	84.4	7.5	Do.
J. L. Goeller	47	2- 0	20.1	17.2	15.9	85.6	7.5	Do.
Walter Meade	48	2- 9	19.2	16.4	15.2	85.2	8.0	Do.
O. B. Ficht	49	1-14	20.0	17.0	15.7	84.8	7.5	Do.
W. F. Howard	50	2- 7	20.3	16.4	15.2	80.8	6.5	Roswell, Idaho.
Geo. H. Brush	51	3- 2	19.5	16.4	15.2	80.0	5.0	Do.
W. H. Ross	52	3- 9	19.5	16.4	15.2	83.9	4.5	Do.
J. H. Trout	53	3-13	17.7	14.4	13.3	81.4	4.0	Do.
L. M. Birch	54	2-14	18.1	14.4	13.3	79.6	5.0	Do.
S. Hill	55	3-14	19.2	16.3	15.1	84.9	4.0	Do.
Frank Johns	56	2- 8	20.7	17.1	15.8	82.6	3.75	Do.
James Crills	57	1-11	19.6	16.7	15.5	85.2	6.5	Nampa, Idaho.
G. D. Ficke	58	1-13	19.4	16.8	15.5	86.3	4.5	Do.
A. Moreland	59	1- 8	19.7	17.0	15.7	86.3	5.0	Meridian, Idaho.
John Berry	60	1-11	19.8	16.6	15.4	83.8	5.0	Do.
I. Yant	61	1- 7	19.8	17.2	15.9	86.9	5.0	Nampa, Idaho.
C. Nofsinger[a]	62	1-13	20.3	18.0	16.6	88.7	5.0	Do.
A. Mickels	63	1- 8	19.0	16.5	15.3	86.9	4.5	Do.
John Halton	64	1-11	21.1	17.5	16.2	87.1	4.75	Do.
Tolef Olson	65	2- 2	19.5	17.1	15.8	87.4	5.25	Do.
J. Brent	66	2- 3	19.2	16.8	15.5	87.5	5.5	Do.
Kate Greene	67	1-10	19.0	16.6	15.4	87.1	5.5	Do.
T. N. Beckner	68	2- 0	17.9	14.7	13.6	82.1	7.0	Do.
Geo. Duval	69	1-10	20.8	17.6	15.3	84.6	6.5	Do.
John Nelson	70	2-15	19.4	16.0	14.8	82.5	6.0	Parma, Idaho.
Chas. Metcalf	71	3- 3	18.8	15.6	14.4	83.0	4.25	Caldwell, Idaho.
N. S. Miller	72	2- 3	17.6	14.5	13.4	81.5	5.0	Do.
A. H. Smith	73	3- 8	18.1	14.8	13.7	81.8	6.5	Boise, Idaho.
A. F. Loveland	74	1-10	18.4	15.9	14.7	86.4	8.5	Deweyville, Utah
Alva Rhodes	75	1- 4	17.8	15.7	14.5	88.2	8.5	Garland, Utah.
John Ward	76	1-12	19.0	15.9	14.7	83.4	7.75	Nyssa, Oreg.
G. W. Jenkins	77	1-10	19.6	16.9	15.6	86.0	7.5	Ontario, Oreg.
Peter Jensen	78	1- 7	20.2	17.2	15.9	85.2	7.5	Nyssa, Oreg.
John Ray	79	2-11	20.1	17.5	16.2	87.1	8.0	Do.
Ennis & Hessie	80	2- 3	20.1	17.3	16.0	86.1	8.0	Do.
A. A. Brown	81	2- 2	20.4	17.7	16.4	86.5	8.33	Ontario, Oreg.
Utah Sugar Co	82	1-11	18.9	15.9	14.7	84.1	8.0	Garland, Utah.
Ed Velberg	83	2- 0	19.6	17.0	15.7	86.7	8.25	Emmett, Idaho.
Alex Pherson	84	2-13	18.5	15.2	14.1	82.2	8.0	Twin Falls, Idaho

[a] Score on Mr. Nofsinger's sample which won the prize was 91.5 points.

BLACKFOOT.—The Idaho Sugar Company is operating a factory at this place of 600 tons capacity. This factory was formerly located at Binghamton, N. Y. Sugar beets grown for it in the East were brought into such close competition with specialized crops that it was decided to move it to this point.

One of the features playing no little part in factory building in recent years is the effect of such an establishment on the values of western cheap lands. Under natural conditions such lands are only valuable for grazing. Give them a sugar factory and an irrigation ditch and their value becomes very much augmented. The main object in establishing many of the factories built in these mountain States is the enhancement of resources and land values of the dis-

trict. This was largely the cause of the removal of this plant to this place.

During its first year, before irrigation had been sufficiently developed, the district surrounding Blackfoot suffered a severe drought, and the beets were more or less affected by blight. During its second year the beets were attacked by an insect pest, and considerable loss of crops resulted in Idaho and Utah on this account. Since its removal here until the present season it may be said that the factory has not been specially encouraged. The past season was quite favorable, and, in addition to beets grown in its vicinity, it received a large number from the overplus grown around Sugar City and Idaho Falls, not far from it. From the results this year the farmers seem greatly encouraged. The prospect is that it will have a large acreage planted next year. On account of the better irrigation facilities and experience gained by the farmers during the past three years the factory seems destined to have a successful future.

Twenty-five thousand tons of beets were grown in this vicinity. From a local newspaper I clip some results of beet growing in the vicinity of Blackfoot during the past season, as follows:

O. J. Cobbley, Riverside, 30 acres; average yield, 15 tons per acre.
G. A. Powell, Blackfoot, 18 acres; average yield, 18 tons per acre.
A Whitton, Wapello, 40 acres; average yield, 15 tons per acre.
J. T. Woodland, Blackfoot, 32 acres; average yield, 16 tons per acre.
William Moore, Basalt, 11 acres; average yield, 15 tons per acre.
J. F. Jensen, Basalt, 15 acres; average yield, 17 tons per acre.
N. Sorensen, Groveland, 16 acres; average yield, 17 tons per acre.

Idaho Falls.—The Idaho Sugar Company is operating a factory here of 1,200 tons capacity. This was the first sugar factory established in the State, and from its results other companies were encouraged to build.

Weather conditions in the district in the early part of the growing season were rather unfavorable. There was an unusual amount of rainfall, and the water standing on the ground from overflows, followed by hot sunshine, caused many of the beets to scald and rot. Taking everything into consideration, the season may be counted favorable, and results were fairly encouraging. A clipping from a local paper gives some of the better results of beet growing in the district during the past season:

Best results of beet growing around Idaho Falls, Idaho, in 1906.

Name.	Area harvested.	Yield of beets.	
		Total.	Per acre.
	Acres.	*Tons.*	*Tons.*
C. W. Rockwood, Iona	50	855.27	17.10
T. C. Barlow, Iona	55	990.39	17.10
H. Bowman, Iona	22	442.13	20.09
C. C. Randall, Grant	10	184.30	18.43
C. J. Call, Rigby	5	119.55	23.93
Woodhouse-Gaddie, Idaho Falls	140	2,478.30	17.50
J. C. Jensen's farm, Idaho Falls (operated by Idaho Sugar Co.)	220	3,316.56	15.07

NAMPA.—For its first campaign at this place the past year the Western Idaho Sugar Company operated a factory of 750 tons capacity. The builders were under contract to have it in readiness by September 1. It was presented to the company on time, probably the first instance of the kind in the history of factory building in the United States.

The season was quite favorable. Considering that this was the first campaign, with the usual obstacles to be encountered under such circumstances, the results were more than usually favorable. The average tonnage was large, and the beets throughout the run maintained a high quality. So encouraging was the first campaign that farmers are pressing eagerly for contracts, and the indications are that the factory will receive an abundance of beets for its second campaign. From a local paper I clip some of the better results of beet growing in the district during the season:

Results of beet growing around Nampa, Idaho, in 1906.

NAMPA DISTRICT.

Name of grower.	Acreage.	Tons per acre.	Name of grower.	Acreage.	Tons per acre.
Mrs. Kate Green	48	14	C. G. Nofziger	18	16
Mrs. Kate Green	10	14	T. M. Beckner	32	15
Geo. Duval	100	16	J. Herman	12	22½
Geo. Duval	26	21½			

BOISE DISTRICT.

J. Keener	17	13	R. H. McNiel	5	20

MERIDIAN DISTRICT.

C. E. Madden	9	14	Robert Noble	12	14
D. Washam	5	22			

PAYETTE DISTRICT.

Henry Ervin	41	16	H. Mason	7½	24
E. E. Hunter	20	22	J. Hill	20	20
McOmie & Albert	31	18			

WEISER DISTRICT.

Peter Pence	31	17	O. W. Baker	15	17
V. Bowers	11	16½			

ONTARIO DISTRICT.

John Ray	10	28	A. J. Quackenbush	20	27
F. W. Sheffield	28	22			

NYASSA DISTRICT.

Gibson & Hunt	30	22			

SUGAR.—The Idaho Sugar Company is operating a factory here of 1,200 tons capacity. This was its third campaign. With experience farmers have improved very much in methods, and beet growing has been much more satisfactory.

It may be said that the weather throughout most of the growing season was ideal. A large acreage was planted. The stand secured was better than usual. The weather continued favorable up to the time of harvest. The beets were larger, and the average tonnage per acre was better than during any other season in the factory's history. I clip from a local paper some results of beet production in this district during this season, as follows:

Results of beet growing around Sugar, Idaho, in 1906.

Name and address of grower.	Area harvested.	Yield per acre.	Name and address of grower.	Area harvested.	Yield per acre.
	Acres.	*Tons.*		*Acres.*	*Tons.*
John Ricks, Sugar	8	16	E. A. Lenroot, Archer	15	18
W. E. Hunter, Parker	22	17	H. C. Robison, Lyman	15	18
H. H. Hunter, Parker	13	18	Theo. Simmons, Lyman	4	16
A. D. Miller, Parker	15	20	H. B. Simmons, Lyman	4	15
D. E. Miller, Parker	20	16	Ed Runnell, Archer	10	20
Wm. Flint, Parker	15	21	Mark Austin, Sugar	20	21
H. S. Jackson, Parker	10	17	L. Thomas (boy of 12), Sugar.	1½	26
W. Baker, Sugar	10	16	Alma Lusk (boy), Sugar	1	30
Reuben and Lee Austin, Sugar			J. Freer, St. Anthony	10	18
J. E. Bigley	15	20	J. Slack, St. Anthony	10	18
James Siddoway, Teton	20	18	E. B. and S. Farm, Sugar	300	15
Mrs. H. Grover, Parker	11	17	J. L. Evans, Rexburg	29	17
Jacob Johnston, Teton	10	18	Eph Ricks, Sugar	13	20
Jesse M. Baker, Teton	20	16	A. J. Hansen, Sugar	5	26

ILLINOIS.

From the inception of the beet-sugar industry there has been considerable agitation in the northern half of the State of Illinois in favor of its introduction. On account of the excellent railroad facilities, large markets, and their availability the State's commercial conditions are especially favorable for this industry.

As in other States east of the Mississippi, capitalists have been inclined to take a conservative stand in regard to investment in sugar factories. Farmers, as a rule, are well satisfied with present crops. There is a wide variety of crops, the soil is productive, and market facilities are excellent. The principal products are corn, cattle, hogs, horses, milk and butter, poultry and eggs. These lines of production have been long established and have proven profitable; consequently the farmers are wedded to them and hesitate to change to something else. As lands are already very high not so much increase in value can be anticipated from the establishment of the sugar industry as in States farther west, where it receives more encouragement at present.

Nearly all of the northern half of the State has agricultural, climatic, and commercial conditions adapted to the industry. The people of many localities have, from time to time, exhibited con-

siderable interest in the matter. It seems inevitable that, with the rise of land values in the West, the State will eventually engage in the sugar industry to a considerable extent.

RIVERDALE.—A small factory of 350 tons capacity, under the ownership of Charles Pope, of Chicago, is now operating at this place, a small town a few miles south of Chicago.

When the facts are better appreciated the results of this factory will be accepted as evidence of the industry's ability to meet competition with well-established crops.

Riverdale is near the town of Harvey, Ill. Around this place for several years were grown from 600 to 1,200 acres of beets for a factory at Kalamazoo, Mich. The yield and quality of beets were both generally good. A number of farmers got an insight into the profits and benefits of beet production. This suggested the building of this small factory at Riverdale. Naturally, under more conservative sentiment prevailing, the progress of such a plant would be slower than that in a new developing district of the West, where crop resources are limited and agricultural development is based largely upon the work of the sugar factory.

Agricultural conditions were generally favorable to the crop at this place during the past season, though it was rather dry during August and rather wet during the early harvest. The acreage secured was not large, but it considerably exceeded that of last year. In comparison with other crops, the beet crop gave very favorable results. The plant is slowly gaining a permanent place in the agricultural industry of the section. In connection with the factory a new beet-pulp drying plant was installed.

KANSAS.

Beet production and sugar manufacture have been under active consideration in many parts of Kansas since the inception of the industry in the United States. The western part of the State, along the Arkansas River, has conditions quite similar to those prevailing in eastern Colorado where beets are grown.

Several years ago the legislature passed a bounty law, offering $1 per ton for beets grown in the State from which sugar was actually made.

Considerable acreage has been grown for several years around Garden City, in Finney County; Deerfield and Lakin, in Kearney County, and at other near-by points. These beets were sold to the factory at Rocky Ford, Colo., and the bounty was collected from the State of Kansas. As a result of this development work a beet-growing district was thoroughly established in these localities in Kansas. These beets, with sufficient moisture, generally returned good yields of excellent quality.

Garden City.—During the past season a sugar factory of 1,000 tons capacity was constructed and operated at this place by the United States Sugar and Land Company. In its establishment occurs one of the remarkable instances of the general development to which I have often referred. The company, prior to building this plant, purchased 27,000 acres of land in Kearney and Finney counties. It purposes building three or four other factories as fast as conditions for furnishing a competent supply of beets will permit. This large land holding by the company has in view two purposes: (1) It gives the company an absolute assurance of sufficient acreage of beets to supply the sugar factories for campaigns of reasonable length; (2) it is inevitable that these factories will so develop agricultural conditions that the value of the lands will be greatly enhanced.

Covering these lands the company owns about 300 miles of irrigation ditches. Most of these had been formerly in use. They had been in the hands of a receiver, had been neglected, were out of repair, and doing the service for which they were intended very poorly. Under the new incentive furnished by the sugar factory this year these ditches were all cleaned out and freed from plant growth and other débris, new laterals were made, and the whole system was put in first-class condition. For some time tests have developed a large supply of underlying sheet water, which led many farmers to put in gasoline pumping engines and open up ditches for private use. The United States Government, under the reclamation act, established a pumping irrigation system costing about $260,000. The whole district took on new life and became busy.

The company leases its lands on shares in 80-acre tracts. On these tracts the tenant must plant and care for a specified number of trees furnished by the company. He must raise not less than 20 acres of sugar beets, one-sixth of the yield going to the company; also, one-third of the small fruit, one-half of the alfalfa, one-eighth of the melons, and one-half of the grain crop go to the company. The company builds for each tenant a four-room house and sheds and barn for cows and two teams, and puts in windmills or pumps sufficient to irrigate the cultivated lands.

The main ditch established by the Reclamation Service runs from Deerfield to Garden City. The pumping plant is located near Deerfield, and transmits power to 24 pumping stations, 12 on each side of the river. Each will draw water from 10 wells. The water pumped on the south side of the river will be conducted through a siphon to the flume on the north side. Farmers receiving the benefit of this Government plant are to reimburse the Government in 10 annual payments.

The company owning the sugar plant is also building storage reservoirs for holding flood waters coming down the Arkansas River in the spring. Such gigantic improvements have thoroughly aroused public interest. On the date of the opening of the United States Sugar and Land Company's plant excursion trains were run, bringing in several thousand people to witness and celebrate the inauguration of the first beet-sugar plant in the State. At its opening the governor of the State delivered the formal address. This indicates the popular estimate of the benefits of this industry.

About 6,500 acres were planted to beets. Weather conditions in the spring and early summer were quite favorable, with a tendency toward excessive rains at harvest time. The tonnage and quality of the beets were highly satisfactory.

The factory was completed and in readiness for the campaign earlier, but on account of excessive rains falling at this time the harvest was delayed and the campaign of the factory opened October 10. Tests of beets at the beginning showed an average of over 16 per cent of sugar.

MICHIGAN.

The progress of the beet-sugar industry in Michigan has been somewhat erratic. While more factories have been built than in any other State, general results have been less favorable. The State has many natural advantages, but there are some drawbacks. In the spring, about the time of planting and germination of the seed or of bunching and thinning, there is likely to be wet, cold, muddy weather. This destroys or weakens the germs, lessening the stand; promotes grass and weed growth; interferes with the work of bunching and thinning, and allows the beets to become foul, requiring extra labor and expense in cleaning fields. Frequently, owing to excessive rains in the latter part of September and during October, the fields become soft. This lowers the quality of the beets, retards the harvest, and results in bad roads, materially increasing the labor and expense of harvesting and delivery of beets.

The obstacles presented to the beet-sugar industry in this State have been very serious. Most of the factories have been compelled to operate short campaigns. Six have been driven out of business, dismantled, and moved to other sections of the country. Those continuing to produce sugar have gradually developed more favorable conditions. It may be said that the remaining Michigan factories have become fairly prosperous and assured of a career of usefulness. The cost of producing beets is considerably less than it was formerly. Campaigns are much longer. The economies are better appreciated. Originally most of the factories were compelled to throw away all their pulp. They not only lost the entire proceeds of a valuable by-

product, but were at the expense of removing it. In a State like Michigan—near large markets, adapted to dairying, feeding, and breeding—the factory should receive for its pulp at least $1 per ton. Each ton of beets costing $5 produces half a ton of pulp worth 50 cents. The pulp produced is equal in value to 10 per cent of the amount paid for beets for the sugar factory. The extravagance of throwing it away in Michigan can readily be appreciated. Yet the factories were compelled to do this. The conditions, however, are rapidly changing. Farmers appreciate more generally the value of this by-product for feeding, and many of them are now consumers. Several of the factories in Michigan have installed in their sugar plants processes for drying the pulp, thus eliminating 80 to 90 per cent of its weight. This furnishes a feeding product readily transportable to all parts of the country. In a short time the entire output of pulp in this State will be utilized at $1 per ton and will either be consumed locally or dried and shipped to market. This means a saving to the factory equivalent to 10 per cent of the entire value of the beets it purchases.

Rapid changes are taking place in Michigan which are beneficial to agriculture generally. Many settlers are emigrating to the State and going to work as laborers and tenants in the beet fields. These are of Hungarian, Russian, and German extraction.

Had the sugar industry built up in Michigan in the manner followed in Colorado, California, and Utah, the conditions of the State would have maintained all the factories ever built, but the process would have been slower.

The first factory was built at Bay City. Soon after others followed at Caro and Alma. These were built in districts well adapted to the beet-sugar industry. If others had not been built near these, interfering with their pioneer progress, each would undoubtedly have developed other outlying districts well adapted to beet growing. When the beet-growing area near each factory had been developed to the extent of the factory's capacity others would have been needed. The growth of factory building and the progress of the industry would have been substantial and logical and those installed would have succeeded better. New factories would have gone into developed districts where there was a local demand for them, and the main obstacle in the way of success—insufficiency of beets—would have been avoided.

In two cases factories were built in Michigan and conditions studied and developed afterwards. In other cases locations were not well chosen. For these reasons removals have occurred. In some of the same districts sugar factories may eventually be built and succeed. This was the experience at Grand Junction, Colo. There is one thing fully demonstrated in the sugar industry—before

facts and conditions in a locality are fully digested no beet-sugar factory can hope to prosper.

I have learned from reliable authority that during the past season 6 of the beet-sugar companies operating in Michigan combined into a single company under the name of the Michigan Sugar Company. Those entering into this new organization were the Alma Sugar Company, of Alma; the Bay City-Michigan Sugar Company, of Bay City, with two plants; the Saginaw Valley Sugar Company, of Carrollton; the Sebewaing Sugar Refining Company, of Sebewaing; the Peninsular Sugar Refining Company, of Caro, and the Sanilac Sugar Refining Company, of Crosswell. The capitalization of this new company is $12,500,000. Its organization represents largely the capital invested in Michigan by the American Sugar Refining Company of New York. This refining company is also the largest stockholder in 9 plants operated in Colorado, under the name of the Great Western Sugar Company. On account of the large interest of the American Sugar Refining Company in these companies in Michigan, they have been working together for two years under a sort of advisory board, composed of a representative from each, the factories, however, operating under separate managements. This new organization brings all these factories together as one concern. The objects are understood to be better results from concentration of management, distribution of the beet crop among the factories, and handling of the finished product through one sales department.

The beet area, estimated at 100,000 acres, planted in Michigan the past season was considerably larger than usual. It may be said, taking everything into consideration, that this was the most prosperous year enjoyed by the beet-sugar factories in the State. The quality of the beets was high, and the average tonnage per acre very much in excess of usual results. The campaigns of most factories in the State were very much longer, the tonnage grown for each was considerably larger, results from every standpoint were more satisfactory, and general conditions are greatly improving. The farmers producing the beets are much better prepared and more inclined to the work. The by-products are consumed to a greater extent. Michigan's prospects in the industry are more encouraging that at any time since its inception. The factories are gradually developing conditions necessary to permanent stability.

In the vicinity of Bay City are three operating sugar factories. The sugar harvest was in full blast the latter part of October. I clip from the Bay City (Mich.) Times of October 23 the following article on the status of beet production in this district:

> The sugar-factory managers of this city are wondering what in the world they are going to do with the flood of sugar beets that is pouring in upon them. Every factory is simply swamped with beets, and everything possible

is being done to discourage farmers from making any more deliveries for the time being. It is estimated that the beets already delivered equal the entire amount of last season's crop and that not over half of the season's crop has been delivered.

The contracts of two of the factories call for the payment of 25 cents a ton extra for pitted beets, while the third pays 50 cents, and it is probable that all will pay the higher amount, as they all want beets pitted and held for several weeks. The German-American Company has enough beets on hand now to run nearly a month and has stopped receiving beets. The West Bay City Company received beets to-day, but the gates will be shut to-night, and no more beets will be received by wagon until next week and no more cars will be loaded. The company has a quantity on cars in the yard now, however, that will be unloaded during the week. The Bay City Sugar Company is notifying farmers to stop deliveries to-day, but expects to receive them again in a few days.

The location of lands in Michigan so near cheap water and railroad transportation and the great markets entitles them to every improvement that will tend to perfect their utility. Beet culture has shown one great need and has pointed out the means of improvement. The excessive rains usual at the planting and harvest seasons do damage to beets, as well as to all other crops. These soils need a system of surface drainage adapted to removing more quickly and readily the excess of water. The same has been true in many parts of Ohio. Lands have been greatly improved in the latter State by a system of open ditches, successive dead furrows, shallow tile drains, etc. Such improvements are, of course, expensive. With ordinary field crops the investment is hardly justified, but with intensive agriculture, such as we have in sugar-beet growing, it is highly practical. With such a system the Michigan farmer could get onto his lands quicker after the rains during planting, cultivating, and harvesting. Cultivation at the right time would give him better control over weeds and grass and eliminate much of the expense occasioned by delay. It would improve the conditions and lower the cost of harvesting and promote the quality and quantity of the beets and other crops grown on his farm. In some of the better beet-growing districts of Michigan this improvement is taking place, particularly in the district growing beets for the St. Louis factory. The real obstacles to beet growing which I have outlined in Michigan will be considerably reduced when it shall have become more general throughout the beet-growing districts.

As an evidence of the appreciation of those best advised with reference to it and its function as a civilizing influence, I publish an extract from an article by Prof. R. A. Moore, agronomist of the Wisconsin Experiment Station, in the Sugar Industry and Beet Sugar Gazette, of Chicago, of November 20. He gives expression to his impressions of the Upper Peninsula of Michigan as follows:

SUGAR-BEET GROWING AN IMPORTANT INDUSTRY.

Instead of the Upper Peninsula of Michigan being a barren waste, only fitted for lumbering, mining, and fishing, we find there some of the finest agricultural lands in the Northwest. It will take but a few years to demonstrate that upper Michigan will vie with its sister State, Wisconsin, in the production of all farm products. The vast forests, together with the lumbering, mining, and fisheries, have, during the past half century or more, shrouded the possibilities of northern Michigan as an agricultural center. The lumbering will soon be an industry of the past, and the population will look to the soil for their support. Large tracts of land have had the heavy timber taken therefrom by the lumbermen and can be easily cleared of the remaining rubbish. No great length of time need be taken before the cut-over lands can be turned into fine farms. Within a few years some of the finest farms that can be seen anywhere have sprung up as if by magic and are now producing bountiful crops. The country is well watered and especially adapted for live stock. Tame and native grasses grow abundantly, affording very fine pasturage. Everything that can be grown on the farms finds a near-by market that can not be beaten. Lines of railroads thread the country and, with many lake ports, put the farmers in easy reach of the best markets in the world.

The farmers of the locality of which I write are especially blessed in having near them an industry that will always be a blessing and be the means of developing the country as no other industry could. The beet-sugar factory located at Menominee stands ready to convert into sugar millions of dollars' worth of beets, all of which find a ready market. Michigan and Wisconsin are leading beet-sugar-producing States, and the fact that sugar beets can be grown everywhere upon our soils has been the means of making farm property eagerly sought for.

Farmers do not realize the full benefit of having the great sugar-beet industry in their midst, and even seem skeptical in regard to its importance. I wish to state, as one having the interest of the farmers at heart, that no one move in the past decade means so much for the farmer as the establishment of beet-sugar factories near rural communities to stop the great flow of money from our country to parts unknown.

The fact that the sugar beet is a great soil renovator is often lost sight of by the farmer, who should realize the fact that cereal crops, especially barley and oats, can be grown to excellent advantage after a sugar-beet crop. When cereal crops are sown the land should be seeded down to clover, and after cutting the clover crop the following year, the second cutting should be turned under early in the season, thus putting the ground in excellent condition for beets the following year. If the second cutting of clover is retained for seed, it is well to manure the ground heavily before turning the sod, or run to pasture for one season. Rotation should be practiced, and the three-year and four-year rotations seem the best.

A farmer should not feel discouraged if he does not get a bumper crop the first year or two, as it takes some little time to learn to grow sugar beets to best advantage. He should remember, however, that there is no farm crop that will eventually bring him so great a net return as sugar beets. The sugar-beet crop in a few years will make his land double its present value. Many farmers live in such close proximity to the factory that they are able to get the pulp for the feeding of dairy animals, thus getting nearly all of the feeding and fertilizing element back from the crop to return to the soil.

Do you, as farmers, stand ready to support your factory in the most effectual ways? Do you stand ready to encourage the men who have put hundreds of thousands of dollars into a plant for the purpose largely of keeping up the industries and price of land in the country in which you live? Do you insist when going to your grocer for the purchase of sugar that you have that which is manufactured in your factory? If not, why not? Is it not the duty of everyone, in city or country, whether he be the grower of sugar beets or not, to stand valiantly by the industry that has for its purpose the development of the agricultural industry of his community?

ALMA.—The Alma Sugar Company has been operating a factory at this place for some time of 750 tons capacity. It has been one of the most successful plants in the State. This company has recently amalgamated with others under the name of the Michigan Sugar Company.

The acreage secured for beet planting during the past season was unusually large. The management in the spring published some results of beet yields in 1905, taken at random from their growers' list, as follows:

Results of beet growing around Alma, Mich., in 1905.

Name of grower.	Acreage harvested.	Value of beet crop.	
		Total.	Per acre.
W. Feichtenbiner	19.0	$1,155.71	$60.83
John Fink	3.1	161.42	52.07
C. L. Fisher	13.0	560.20	43.09
W. F. Fleming	1.5	62.78	41.85
Samuel Fletcher	6.0	505.19	84.19
W. I. Ferguson	1.0	46.42	46.42
B. F. Freed	3.0	214.32	71.44
W. H. French	1.0	54.04	54.04
Edwin F. Gee	9.0	751.67	83.52
Frank Gilkin	9.5	476.16	50.12
Glenn Wagner	2.0	91.79	45.89
W. H. Godfrey	19.0	941.35	49.54
George Godfrey	.25	11.04	44.16
Daniel Goggin	11.5	567.19	49.31
Turley Grant	3.5	169.68	48.48
James K. Griffith	2.0	107.53	53.76
J. A. Griffith	2.5	100.10	40.04
Henry Gover	5.0	410.79	82.16
John B. Hall	3.0	219.36	73.12
Otis A. Hampe	1.8	102.14	56.74
Wm. M. Harrier	.25	23.85	95.40
E. J. Hasbrook	5.6	360.95	64.45
Allen Hazelton	10.0	623.72	62.37
Eckert & Hazelton	9.0	391.74	43.52
David Heistand	5.0	405.14	81.03
L. B. Sawyer	6.4	327.24	51.13

During the early spring and growing season of 1906 the weather was more nearly ideal for this crop than any before experienced in the factory's history. So steady and bountiful was the inflow of beets on account of ideal harvesting weather that all available space for storage was taken up and the factory was compelled to call off deliveries for a while. The quality of the beets was hardly up to that of some other seasons, but the yield was far beyond expectations. Everything considered, this was the ideal year of the factory's experience.

Some blight appeared in the beet fields, thought to be due to extreme heat during the latter part of the growing season, but the damage was not serious.

At this plant all pulp is dried and shipped to available points for stock feeding. In the beet fields a new beet harvester was tried. Results indicated very good work.

Bay City.—The Bay City-Michigan Sugar Company has been operating a factory at this place of 600 tons capacity. It has 2 plants here, one of which has remained idle for some time. Recently arangements have been made for removing it to Waverly, Iowa.

This is one of the companies recently amalgamated under the Michigan Sugar Company. It is one of the earlier factories built in the State. Its campaigns have never been of sufficient length on account of the 5 factories installed in so small a district as that occupied by the former 3 factories at Bay City and the 2 at Saginaw, 8 or 9 miles from each other.

The acreage planted was larger than usual for this plant. The weather conditions prevalent throughout the season were generally favorable and the harvest was highly satisfactory. The average tonnage of beets was higher than ever experienced before. The quality was up to standard.

During the latter part of the harvest the plant was compelled to shut down for a short while on account of the excessive rains, which caused bad roads and made it impossible for farmers to deliver beets. There are 1,600 contracting farmers growing beets for this factory. In the Bay City district are about 5,000 farmers growing beets for this company, the West Bay City factory, the German-American Company, and the National Chicory Company, which consumes considerable beets. The three companies in their November payment to farmers dispensed $496,300. This was for only one month's delivery. In December the payment to farmers was $310,200. For the entire campaign it is estimated that in this district was paid to farmers for beets $1,000,000.

Blissfield.—This factory is located in Lenawee County, in the southern part of Michigan. It is of 600 tons capacity, and is operated by the Continental Sugar Company, the same company that operates the plant at Fremont, Ohio.

This district has been growing sugar beets for some time for the plant at Fremont. It was due to this experience that the Blissfield plant was built. This is the second year of operation. The weather conditions throughout were quite favorable; the acreage planted for the factory was large; the yield was very satisfactory, and the quality of beets was all that could be desired. The plant experienced a long and successful campaign.

Caro.—The Peninsular Sugar Refining Company is operating a factory at this place of 1,200 tons daily capacity. This is one of the 6 companies recently amalgamated into the Michigan Sugar Company.

The early season was quite favorable for preparation of the seed bed and early planting. Throughout the district grub worms appeared to some extent and did some damage. The growing season was normal and the early harvest more than ordinarily favorable. Although the season throughout might be considered favorable to the growth of the beet crop, the sugar contents of the beets were not as favorable as was anticipated. The American Sugar Industry and Beet Sugar Gazette of November 11 refers to these conditions as follows:

> The fact that beets have been showing lower percentages than usual of late has caused considerable speculation on the part of the farmers, and, of course, it is equally vital to the interests of the company. Beets sent in September for analysis averaged 16.3 per cent; during October the average fell to 14.7. The season has been quite different in several respects from that of last year, and certain conditions have lowered the percentage of sugar. The conditions mentioned are the results of dry weather and early cold. The dry weather is principally responsible. This caused beets to cease growing, and instead of ripening up fully and filling with saccharine matter, large numbers of the roots stopped growing and showed a tendency to wither. As a consequence it is found that in many fields a portion of the beets favored by location will be found ripe and will run well up in sugar, while in another section of the same field the beets are undeveloped, partially green, and the sugar content is low. During the dry weather of October the beets, which had just begun to store sugar rapidly, went back in percentage, owing to the cessation of growth. In the latter part of October the percentages showed a rise, and for the last few weeks beets delivered have slowly increased in sugar. A glance over the books at the office of the Caro plant shows that the analyses are continuing favorable, and the average for November will show up much better.

Carrollton.—The Saginaw Valley Sugar Company is operating a factory at this place of 800 tons capacity. This was one of the 6 recently amalgamating into the Michigan Sugar Company.

The company secured a large contracted acreage. Throughout the growing season weather conditions were unusually fine.

During the campaign of 1905 the management of this factory, in order to come into closer touch with its growers, invited them in to inspect the factory and engage in general conference with each other and the management regarding mutual interests in the industry. This year the same plan was followed, and it is the aim of the company to continue this custom. Hundreds came in by wagons and buggies from the district and from a distance on the railroad by excursion cars. A programme was arranged and lunch served. The results of the meeting were highly satisfactory to all.

Beets grown for this factory were of unusually high quality. The yield was more satisfactory than for several years. A new beet harvester, manufactured locally, was tried in the beet fields this season, and its operation was fairly successful.

The pulp produced by this factory is nearly all consumed by feeders in the vicinity. The stock industry has been very much improved on account of pulp-feeding facilities.

Charlevoix.—The West Michigan Sugar Company is operating a plant here this year, for the first time, of 600 tons capacity. This factory has been several years in building. From one cause or another its completion has been retarded. It has grown during this time a considerable acreage of beets, which have been disposed of at other plants. During the present season about 2,000 acres were planted. The season was not nearly so favorable in this district as in others in the State. It experienced an early drought, which lasted far into the growing season. Many of the farmers became discouraged and did not continue the cultivation of the beets, and considerable of the acreage planted was lost on this account. Where beets were well taken care of by farmers results in the end proved more favorable than anticipated. The fact that the factory actually ran a campaign and that good beets were produced where careful culture was given will do much to encourage the industry in this district.

Croswell.—The Sanilac Sugar Refining Company is operating a plant at this place of 600 tons capacity. During the summer a number of improvements were made on the plant. The season throughout the district was quite favorable, being similar to that in the other factory districts in the central and southern parts of the State. The contracted acreage was large enough to insure a campaign of fair length. Owing to the favorableness of the season, the average tonnage and total production were considerably larger than anticipated.

This is one of the companies recently amalgamating with others under the name of the Michigan Sugar Company.

Holland.—The Holland Sugar Company has been operating a factory here of 350 tons capacity for several years. Although this is the plant having the smallest capacity in the State, it has probably achieved uniformly better results throughout various campaigns. Its contracted beet area was about 4,000 acres. The season was generally favorable, although it was a little too dry from the middle of July to the middle of September and too wet in the early harvest. The yield was not as heavy as in some other years nor the quality as good. Considerable of the pulp is consumed, but not all. Feeding, dairying, and creamery interests have been very much benefited in the locality.

During the summer the factory was overhauled and many repairs and improvements were made.

Lansing.—The Lansing Sugar Company is operating a factory here of 600 tons capacity. The acreage contracted and planted to beets was 7,000 acres. This is the largest acreage ever secured by the factory. The plant started earlier than usual.

During the preparation of the seed bed, planting, and germination it was rather wet and cold, and there was a tendency to drought and hot weather in July and August, followed by heavy rains in the early harvest. Some blight developed, being more serious in the southern part of the district and generally noticeable throughout all of it.

Considerable pulp is consumed locally. Farming interests generally contend that beet culture has a decided tendency to promote the returns and care given to other farm crops.

Marine City.—The Marine Sugar Company operates a factory here of 350 tons capacity. This district is located near the eastern border of Michigan. It has been difficult for this company to procure beets enough grown in Michigan to sustain it. Many of its beets were grown in Canada. During 1905 the United States collector of customs imposed a duty on these beets, according to the vegetable rate of our tariff schedule. This was somewhat discouraging. In the early spring the company decided not to operate the plant during the campaign of 1906. Beets grown in this district were shipped to other factories in Michigan.

Menominee.—The Menominee River Sugar Company is operating a factory here of 1,000 tons capacity. Menominee is located in the Upper Peninsula, where conditions are somewhat different from those in the Lower Peninsula.

This factory usually has from 40,000 to 50,000 tons of beets. About 12,000 tons of these beets are grown locally. Half of its supply is grown over in the near-by counties of Wisconsin. Many of the beets worked in this factory are grown near the lake shore and delivered by barges.

In order to sustain a long run this factory should have in the neighborhood of 100,000 tons of beets annually. Farmers are improving their methods; the average yield of beets becomes larger each year. A demand is growing for the pulp for feeding purposes, one firm sending in last campaign an order for 1,500 tons.

The farmers and factory management are better satisfied with the results of this campaign than any other since its beginning. Everything tends to encouraging a considerably larger planting next year. The average yield was about 11 tons per acre; the first year it was only 6.

Mount Clemens.—The Mount Clemens Sugar Company operates a factory of 600 tons capacity at this place. The district shared with most of Michigan in the results of a season favorable to beet growing. A large acreage was secured, and the average tonnage through-

out was equal to that of any other season in the factory's history, and the campaign was longer.

The management of this company believes in keeping in close touch with the growers. Every year at some period during the campaign excursions are held and a day is devoted to showing the beet growers the workings of the factory and to mutual consultation. This event occurred this year on December 15.

Owosso.—The Owosso Sugar Company is operating a factory here of 1,000 tons capacity. The estimated area planted to beets in 1906 was 11,300 acres. In order to take care of this large acreage it was necessary to import a number of laborers.

The campaign of the past season at this place was the longest, the yield the heaviest, and the beets of the highest quality in the factory's experience.

This company owns several thousand acres of land upon which it grew about 1,000 acres of beets. The season was not altogether favorable, being too dry, with excessive rains at harvest. From April 1 to November 1 this district received 11.25 inches of rainfall.

A new beet harvester was tried in this district with generally favorable results.

St. Louis.—The St. Louis Sugar Company has been operating a factory here of 600 tons capacity. The management of this company has adopted the idea of annually assembling its beet growers for inspecting the sugar industry and for consultation. About 6,000 farmers visited the factory on the day set apart for this purpose during the campaign this year. About 1,500 contracting farmers are engaged in producing the beets. Farm work in this district is generally conducted on the best methods. Considerable attention is given to drainage, and the methods of farming are generally of the better sort. The acreage planted to beets was larger than usual. The yield was better than in any other year of the factory's experience, but the quality of the beets was hardly up to normal.

Salzburg.—The German-American Beet Sugar Company has been operating a factory of 400 tons capacity at this place. This factory has been unique in Michigan sugar production, on account of its feature of cooperative stock. In its immediate vicinity are two other large factories. The season was a little too warm and dry.

The Salzburg factory has been more uniformly successful in securing beets and conducting long campaigns than any of the other Michigan factories. It secured a large acreage from which the yield was more than normal, and beets of high quality were secured. It is estimated by the local management that from the beets grown in the district surrounding Bay City at least 30,000,000 pounds of sugar were made this year. There were about 1,500 contracting farmers growing beets.

The factory dries its output of pulp and ships it to market for stock feeding. This drying plant was installed this year.

Sebewaing.—The Sebewaing Sugar Refining Company operates a beet-sugar factory of 600 tons capacity at this place. The yield and quality of sugar beets in this district during the past season was quite fair.

This is one of the factories recently amalgamating under the name of the Michigan Sugar Company.

West Bay City.—The West Bay City Company has been operating a factory at this place of 600 tons capacity. Previous to this year the factory never has had a large area contracted, nor received a supply of beets sufficient to give it a campaign of fair length. This year, however, it experienced a favorable season. Its acreage was larger, the yield better, and the beets of higher quality than in any other campaign since its inception.

Working in the three factories in this Bay City district are something like 800 men. During the harvest employed in the beet fields are about 3,000 laborers. Growing beets for them are about 5,000 farmers. It is estimated that they received for the raw product about $1,000,000. The sugar contents of many of the beets ran so high this year that many farmers received $6 a ton.

MINNESOTA.

For several years beet sugar has been manufactured in the State of Minnesota. The original plant was in operation at St. Louis Park, a suburb of Minneapolis. When first established the acreage producing the beets for its first campaign was small. An unusual drought occurred during the first two years of its operation, seriously affecting the yield of all crops and affecting to some extent beet production. This was followed by excessive rains for a couple of years, interfering with crop production, but in both instances results were more favorable to beets than to other crops.

During these years the management had difficulty in securing contracts from the farmers. The beets were grown over a wide area, covering Minnesota and parts of Iowa. Each successive year the area covered grew less, while the acreage grew larger, the beets better, and the farmers more satisfied. Gradually it reduced its beet-growing district to southern Minnesota and within a radius of 50 miles of the factory. To accomplish this work required industry and careful management on the part of those operating the plant. In construction the factory itself was not ideal, for the factory building was an old harvester plant, remodeled and fitted with sugar-making machinery.

Two years ago a cyclone badly damaged the factory, delaying its campaign and causing a large outlay for repairs. A year ago it took fire and was completely destroyed. The beets grown for it were sold to the management of the factory at Menominee, Mich., and worked up there.

CHASKA.—Michigan interests owning the beet-sugar factory at East Tawas, where a large plant had been unsuccessfully operating, decided to move it to Minnesota and occupy the territory made vacant by the destruction of the factory at St. Louis Park. A location for the plant was found at Chaska, about 30 miles south of Minneapolis. The Carver County Sugar Company is operating the plant. This is its first year at this place. It has 600 tons daily capacity. The location is much better than the one at St. Louis Park. It is in the center of its beet-growing area, while St. Louis Park was not a point favorable to wagon delivery, and most of the beets had to be shipped to it by rail.

The Chaska plant started under favorable circumstances. Its pioneer work had been accomplished. Beet growers had had a long experience, and did not require experimental stages of development. The crop list in the district tributary to Chaska is very favorable to beet production. The principal farm products are small grain, potatoes, cucumbers for pickling, and sweet corn for canning. Alfalfa is also produced quite extensively. This is one of the favored crops for use in rotation with sugar beets.

Before the campaign and after the completion of the factory excursions were run bringing many business men of Minneapolis and the farmers of the vicinity to examine it and get in touch with the industry.

In addition to the beets produced for this factory in the southern part of Minnesota, about 1,200 acres were grown at Waverly, Iowa, some distance south, in order to test conditions around this Iowa town. Michigan parties holding the largest stock interests in the Chaska plant were also under agreement to build a factory at Waverly of the same size, provided conditions would warrant.

The Chaska factory is located on the Minnesota River, in Carver County. The price of beets is $5 per ton at the factory. The beet-growing area experienced a very favorable season. The yield was larger than normal in the State and of excellent quality.

MONTANA.

Considered as a beet-sugar producing State, Montana has natural conditions quite similar to those of Colorado and Idaho. Agricultural development is largely in a transitory state. Agricultural

production under irrigation is just beginning. Throughout the eastern two-thirds of the State are many fertile valleys. Cropping is dependent largely on irrigation facilities. Draining this portion of the State from west to east flow two great rivers, with their branches—the Yellowstone of the south, and the Missouri of the north, with its branch, the Milk, and its north and south fork.

Through these rivers pours an immense drainage of water collected in the mountains in the western portion of the State from rains and melting snows. Throughout these valleys in all parts of Montana extensive experiments have been conducted to test conditions for beet-sugar production. The great drawback to active operations in this industry is the lack of settlement, labor, irrigation, and facilities favorable to intensive agriculture; but these are rapidly developing.

Billings.—The Billings Sugar Company operated a factory of 1,200 tons capacity at this place this season for the first time. On account of the newness of the industry, lack of labor, and general inexperience of the district, many difficulties were encountered in growing the beets. The season may be considered quite favorable. A windstorm in June damaged 400 acres. Where proper attention was given to cultivation and care of the crop, results for the first year were highly encouraging.

Outside demand for pulp the first year was not extensive. The company fed on pulp about 1,000 head of cattle and 9,000 head of sheep.

NEBRASKA.

Nebraska has been producing beet sugar for fifteen years. The factories are located in the eastern half of the State, as the organizers believed it better adapted to the beet-sugar industry. It is clearly in what is known as the corn belt. Crops are produced under rain conditions. The yield is heavy. The soil is a sandy loam, is responsive, and the seasons are fairly reliable.

The two factories are located at Grand Island, about 120 miles west of Omaha, and at Leavitt, 40 miles west of Omaha. It was difficult to interest farmers in beet production. Lack of labor and other causes have interfered with the general progress of the industry to a considerable extent.

Except in one or two years of excessive drought it may be stated that beet production has ordinarily resulted favorably. A few years ago irrigation was introduced in the western part of the State along the North Platte and Republican rivers. Around the towns of North Platte, McCook, and several other points beets were grown. Gradually the acreage was increased, until at the present time the principal

beet-growing area for the two factories at Grand Island and Leavitt is tributary to the ditches in this western section, watered by these two streams.

For these two factories over 11,000 acres of beets were grown in this western district last year. Conditions in the two sections of the State are remarkably different. In the irrigation section of the State alfalfa was introduced with sugar beets. These two crops together have proved to be the best adapted for utilizing the advantages of irrigation. Throughout both the eastern and western areas in which sugar beets are grown the conditions were more favorable this year than for some time.

The factory at Norfolk was removed and installed last year at Lamar, Colo.

After the factory at Leavitt had worked up a considerable beet-growing acreage in the western irrigated section Mr. James Scilley, an expert beet grower, was sent to oversee the work in the district tributary to North Platte, Nebr. He had acted in the capacity of assistant agriculturist at Leavitt, has had long experience, and is considered one of the best advised beet growers in the country. I insert here a short report from him bearing on conditions of beet production in the North Platte district during the past season:

> We have had splendid crops this year. Farmers have all made money and are feeling good. I have had a very successful season. There were about 8,000 acres grown in this territory in 1906. Our yields reached as high as 30 tons per acre. I believe the entire acreage will average 12 tons per acre. Beets tested from 14 to 16 per cent of sugar, with a purity of 82.
>
> Our soil varies from a sandy loam to an alkali gumbo. We have a very good system of irrigation, consisting of four ditches tapping the North Platte River at various places on the south of the river, and one ditch on the north side of the river, tapping the Birdwood. We have all the water necessary. This territory is well developed, and in my opinion it will only be a short time until a factory will be built, as the field is ripe and very inviting.

Grand Island.—The American Beet Sugar Company operates the factory here, which is of 350 tons capacity. This factory was the third to operate in the United States.

In addition to the beets grown in the vicinity of the factory and delivered to it by wagon, it receives a large acreage from the western part of the State, grown under irrigation.

Although this factory has operated a number of years, everything taken into consideration, this season is considered the best of any yet experienced by the plant. The average tonnage per acre was good and the beets were of high quality.

Leavitt.—The Standard Beet Sugar Company operates the plant here, which is of 1,100 tons capacity. As with other factories in the State, at first its entire acreage was produced in its vicinity under

conditions of rainfall, but now the bulk of its beets are grown on the irrigated lands of the Platte and Republican rivers, in the western part of the State. While freighting such a distance necessitates considerable expense, the plant has a better assurance each year of a larger tonnage, insuring it longer campaigns.

For several years 1,200 to 1,500 acres surrounding the factory and belonging to the Standard Cattle Company were planted to beets, but finally these lands were sold. Most of the cultivated land of this vicinity are in the Platte bottom. While very rich and usually yielding very well, it is so low and level that drainage is poor. In case of excessive rainfall beets suffer quite materially. The damage on account of floods may occur in the spring or at harvest time. Throughout its existence this company has experienced many difficulties on account of this lack of drainage, washing of the land, and its saturation with water. This induced the contracting of a larger acreage in the irrigated districts farther west. While a considerable acreage of beets is now grown for it in its vicinity, at least 75 per cent of them come from this western section. Extra expense of shipping from such a distance is probably overcome in the advantages that accrue to the factory from the better quality of the beets.

A large acreage was produced for this plant in 1905. The yield was good, but on account of the unfavorableness of the latter part of the growing season the quality was very poor. While the factory had a long campaign, it is claimed that its profits were practically nothing. During the summer the plant had doubled its capacity, thereby considerably increasing its cost of construction. These improvements were made largely on borrowed money, and it was anticipated that with the large acreage and fine yields of beets the profits of the factory would pay for the improvements; but on account of the low quality of the beets and high cost of sugar production, with these heavy expenditures, it got into financial difficulties. Farmers did not receive money for a large part of their crop, the plant finally went into the hands of a receiver, and under his direction it is being managed now.

In 1906, taking everything into consideration, the factory experienced a highly favorable season and secured a more than normal yield of beets of excellent quality. In the eastern part of the State excessive rains prevailed in the early season, and during the late summer it was dry. These two conditions reduced the yield. In the irrigated sections growing beets for this factory farther west the spring was exceedingly favorable. An abundance of rain occurred during the fore part of the summer. With the exception of early snows in October, the season was more than usually favorable.

NEW YORK.

For several years New York has been producing sugar from beets. While natural conditions are quite favorable in many places in the State, the industry has had more difficulty in getting a foothold than in any other section where installed.

There are some things especially favorable to beet-sugar production in New York. Under the laws the State pays a bounty of $1 per ton to the sugar factory for all beets worked, provided the sugar factory pays the farmer $5 per ton for the beets.

Farmers and dairymen have been accustomed in this State to feeding the refuse and by-products of distilleries, starch manufactories, breweries, etc., and after the installation of the sugar factories the benefits of pulp feeding were generally appreciated from the start. The factory in this State finds a more ready sale for pulp than any other in the United States.

Notwithstanding these encouraging features, this company has experienced many difficulties in getting the farmers to grow the crop. Grown in New York are many reliable, well-established, special crops, like broom corn, peppermint, cabbage, and many garden vegetables, and these have made it difficult to persuade farmers to change to a new crop like sugar beets.

Lyons.—The Lyons Beet Sugar Refining Company has been operating a factory here of 600 tons capacity for several years. During the past season many improvements were made on the factory. The principal item worthy of mention was the installation of a pulp-drying plant, costing about $40,000.

Soil conditions as affecting beet culture in the vicinity surrounding Lyons are more peculiar than at any place I have visited throughout the beet-growing area of the country. It is generally believed that beet soil must be absolutely free from stones, pebbles, and the like; that these will interfere with the form and quality of the beets. In this vicinity during the past season fields of beets were growing where at least one-third of the visible portion of the soil consisted of pebbles and stones from the size of a bird's egg to that of a cocoanut. One could hardly understand how such land could be hoed and cultivated, yet the best beets examined grew on such soil, and it was the belief of the agriculturist that these were the best beet lands for this purpose in the beet-growing area of this factory.

From 1,000 to 1,200 Italians are laboring in the beet fields of this district, having been brought in to assist in this industry.

In some parts excessive rains, with hailstorms and floods followed by hot weather in July, did damage to the crop. Taking everything into consideration, the season was considered favorable.

OHIO.

Sugar from beets has been manufactured in the State of Ohio for a number of years. Through many difficulties the industry has struggled to its present highly successful status. Its career in this State was something like that in Minnesota, New York, Oregon, and Washington. Its progress in winning favor with the farmers was slow but sure. The factory was located at Fremont, Ohio. In the beginning its capacity was small, it was difficult to secure sufficient beet acreage, and its campaigns were short. Feeders were slow to realize the value of its by-products. The press and public generally were nonappreciative.

Through such discouraging circumstances the plant gradually intrenched itself in the industrial affairs of the State. Each succeeding harvest gave a larger tonnage of beets. Its campaigns gradually lengthened. Its capacity was increased. More beets were produced in its immediate vicinity. Contracts for those at a distance grew less. The year of 1906 finds it literally swamped in an avalanche of beets grown at home. The agricultural and business interests of the State are aroused to the industry's importance. Its popular commendation is general.

During the present factory's career it has built up a permanent beet-growing area competent to supply several times its original capacity. Formerly a considerable acreage of its beets was grown in northwestern Ohio, near the line of Michigan. When conditions favored, it withdrew from this territory on account of the distance. The same company then built another plant at Blissfield, Mich. During the past season more beets were grown for the Fremont factory in the farming district tributary to Defiance than it could originally secure in the whole State. Enough beets are now produced there to sustain a sugar factory. The original factory can secure enough beets in its own vicinity to run a long campaign. The indications are that a factory will be needed at Defiance to take care of the beets grown there.

The State possesses many advantages for the beet-sugar industry. Its farms are usually small, productive, and adapted to intensive agriculture. The demand for sugar in the State is very large; markets are near; fuel is of good quality and comparatively cheap. Considerable stock is grown on the farms. Farmers as a rule are of the better class.

Fremont.—The Continental Sugar Company has been operating this factory, which has a capacity of 400 tons. It is the pioneer in the State, and beet production has overleaped its facilities for manufacturing sugar.

The season, everything considered, was the most favorable yet experienced in the history of the factory. A large acreage of beets was secured. The tonnage produced for it was by far the largest in its career.

At Defiance a large acreage was planted to beets for this factory during the past season. Nearly all the farms were originally in timber, and the lands are named after the prominent species of timber which grew on them, as elm land, oak land, etc. These lands became too wet as the result of excessive rains in the spring and occasionally during the growing season or during harvest. Without some method of removing the surplus moisture lands are of little use for cropping. On this account many of these lands were for years of small value. Finally a system of drainage was introduced. This consisted of open drains bordering the low places in the small fields or tile drains put in at a depth of 1½ to 2 feet. To aid this surface drainage, the lands are plowed with a system of dead furrows not far apart, extending across the field in the right direction for drainage. While inspecting beet fields during the past season it became my privilege to observe the need for such a system. A heavy rain had just fallen, and I saw in several places 2 or 3 acres of beets standing in surface water. The weather was hot, and in two or three days the beets were scalded and became soft and rotten.

The management of this factory has a very unique and effective system of governing its experts in the beet fields. For the factories at Fremont and Blissfield and for other districts, like that around Defiance, having a large acreage of beets, it maintains a corps of experts or agriculturists. Altogether about 36 of these are employed. At some time in the growing season, after the beets are laid by, the management assembles this corps of experts for four or five days at some convenient point along the lake. This gives them a rest and an outing in the season between cultivation and harvesting. Twice a day they are assembled together for mutual discussion of matters pertaining to their work in the field. After advising with these men, who are its active agents for dealing with the farmers, the management gives instruction on the work of the coming harvest. The management gains from the experience of the field men and comes into closer touch with the conditions that have to be met. The men gain from learning one another's experiences. I attended this conference at Put in Bay, Lake Erie, during the past summer. I was very much impressed with the evident results of such a plan, and can heartily commend it to the consideration of other factory managements in this country.

This factory experienced the car-shortage difficulty prevalent throughout the country. On account of the large tonnage produced

this proved very serious in some localities. Many of the beets had to be siloed, which resulted in considerable loss.

OREGON.

Sugar has been manufactured from beets in Oregon for a number of years, but the progress has not been as rapid and pronounced as in some other States. While the acreage planted and the tonnage produced have been increasing each year, it may be said that general reception of the industry by the public has not been enthusiastic. This is largely due to conditions other than agriculture. There can be no doubt about the adaptability of many parts of Oregon to the beet-sugar industry, especially the Grand Ronde Valley, where the factory is located; but the hard work incident to growing beets has not appealed to the farmer in the locality where it was established. After the first year's experience considerable discouragement was felt by many farmers in its vicinity. It became necessary for the management to make contracts at various outside places at some distance from the factory. This made progress slow; but more permanent beet growers have gradually been added to the list. It may be said that people are becoming more generally favorable, and appreciate to a greater extent the benefits of the industry. A larger acreage is being planted near the factory than formerly.

Lagrande.—The Amalgamated Sugar Company operates this plant, which has 400 tons capacity. For planting the seed, bunching, and thinning, the weather conditions were very favorable; but there was some dry weather during the summer and storms during the harvest. In July the manager of the factory estimated that 3,600 acres were planted, and 3,500 of these had a good stand.

More laborers were brought in this year to work in the beet fields. Among these were several hundred Japanese and a large number of Umatilla Indians. This particular section produces fruit extensively. Fruit culture and harvesting demand considerable labor. In competing for labor the two interests conflict to some extent.

One improvement which materially benefited this district was the building of a spur road, equipped with facilities for loading beets. This extended the beet-growing area.

The factory was shut down about two months during the campaign on account of stormy and cold weather which prevented harvesting.

Generally considered, results of the past season were more favorable than usual.

UTAH.

The beet-sugar industry in Utah is not so extensive as in Colorado, Michigan, or California, but its progress has been more remarkable. It has developed with a steady growth.

It does not appear that natural conditions of soil and climate are as favorable to large yields or to beets of high quality as in Colorado. In fact, the history of the first factory shows that for several years the tonnage was not large and the quality was only fair. The success of the industry in the State may be said to be due largely to the industry, habits, and staying quality of the farmers. The farms in Utah are small, and the necessity of making the most out of them is a pressing consideration at all times. While irrigation was practically in its infancy at other places Utah had thoroughly established systems of watering the soil. The people of the State have builded and progressed on the basis of intensive production. The requirements of the sugar industry conformed to their habits and aspirations. They had the patience and were willing to acquire the skill. They act more in unison to a common purpose than any other community of farmers it has been my experience to observe. With little public parade, through hardships and many difficulties, the first plant met its problems, solved them, and increased its manufacturing facilities to keep up with beet production. Finally it built another factory, and it is now actively considering the installation of others. Taking advantage of the progressive tendency to beet production, another company was organized in the State. In response to the rapid development of its beet-growing area, it built a second factory, and, finally, a third. Beet-sugar production in Utah is conducted entirely under the management of these two companies.

Some things of interest have been developed in the State of Utah which redound to the benefit of the whole industry. One year blight affected the beets, materially reducing the tonnage. Many thought the affliction would be carried over into the beet fields the next year. This did not occur. In 1905 the beet fields were seriously affected with the pest known locally as the "white fly." This proved very serious in all the beet fields of Utah and Idaho. From this cause it is estimated that the Utah Sugar Company alone lost 75,000 tons of beets. Many farmers refused to contract for beets for 1906, fearing a transmission of this pest to the crops, but this did not occur. There was very little evidence of its ravages during the past season. The season itself proved to be one of the best ever experienced in the history of beet-sugar production in Utah. A shortage of cars was the only real obstacle encountered this year. This is one that seems to have prevailed throughout the beet-sugar districts in all parts of the United States. The tonnage was heavy and the beets were of a high quality.

As an evidence of the importance of the industry in the State of Utah, I clip from the Deseret News (Salt Lake City) of December 15 a compilation of the resources and results of beet-sugar produc-

tion in that State for 1906. On this subject this secular paper is perhaps better informed than any other paper in the United States:

Results of the beet-sugar industry in Utah for 1906.

Total acreage	acres	27,100
Total tonnage	tons	365,000
Average yield per acre	do	13.47
Total capital invested		$9,100,100
Total money paid farmers for beets		$1,675,000
Total money paid by factory for labor		$270,000
Output of sugar (see table below)	pounds	78,000,000
Value of refined sugar at 4½ cents per pound		$3,510,000

Results of factory operations in Utah in 1906.

Name and location.	Estimated production of sugar.	Daily capacity for working beets.	Estimated length of campaign.	Number of factory employees.	Number of farmers growing beets.
	Pounds.	*Tons.*	*Days.*		
Amalgamated Sugar Co., Ogden [a]	12,000,000	400	120	200	1,100
Amalgamated Sugar Co., Logan	10,000,000	600	110	200	950
Lewiston Sugar Co., Lewiston	9,000,000	600	110	200	900
The Utah Sugar Co., Lehi	27,000,000	1,200	125	306	1,800
The Utah Sugar Co., Garland	20,000,000	600	120	160	500
Total	78,000,000			1,066	5,250

[a] Does not include the output of the factory at La Grande, Oreg., which will amount to about 2,250,000 pounds.

Garland.—The Utah Sugar Company operates a plant here of 1,200 tons capacity. For some time beets were grown to a greater or less extent for the Lehi factory. The district is watered through canals supplied from Bear River. The beets grown are usually of high quality. The soil is productive. The farming element of the district is not well organized, and the district itself is rather a new one. The company never has received sufficient beets to give a plant of its large capacity a long campaign. The past season resulted more favorably than any preceding season.

While the acreage secured for growing beets for this plant was not large, the yield was very heavy, several farmers securing as high as 30 to 35 tons per acre. Under these ideal conditions it is estimated that the plant had about 83,000 tons of beets, that the average yield was 16 tons per acre, and that the sugar contents averaged 16 or 17 per cent.

Developing this district to this high productive point has been quite difficult. The results may be attributed to some extent to the favorable season. A great deal is due to the efficiency of the farmers, acquired after a few years' experience. The soil for beet purposes is of excellent quality. The district has plenty of water, and the farmers are coming to understand more thoroughly their part of the work.

A feature of general interest is the Utah Sugar Company's production of beet seed. It has been engaged in this for several years. Most of the work is carried on in the Garland district. The company also cooperates in experimentation with the seed experts in the Bureau of Plant Industry of the United States Department of Agriculture.

Most of the refuse sirup of this factory is shipped to feeders at Omaha, who mix it with chopped alfalfa and other material for cattle and sheep feeding. It disposes of most of its pulp for 50 cents per ton.

I clip from the Deseret News (Salt Lake City) of December 15 a compilation of results from a few of the leading beet growers for the Garland factory, as follows:

Results of beet growing around Garland, Utah, in 1906.

Name and location of grower.	Area harvested.	Yield per acre.
	Acres.	*Tons.*
H. L. Steed, Corinne	55	18.3
D. W. Hunsaker, Honeyville	23	18.21
Geo. C. Peck, Fielding	24	19.41
J. T. Bigler, Riverside	22	18.64
O. Jensen, Honeyville	38	18.94
Merrill Salt Co., Brigham	25	18.87
James Nelson, jr., Thatcher	30	21.94
M. Hall, jr., Garland	22	18.34
R. C. Richards, Riverside	23½	18.82
J. P. Holmgren, Bear River City	67	17.75
J. M. Hawes, Elwood	23	21.91
Beet Growing Association, Garland	104	18.23

Lehi.—The Utah Sugar Company is operating a plant here of 1,200 tons capacity. This plant is unique in that it is a combination of beet-sugar plants. The main plant has a capacity for turning out the sugar from the juice of about 1,200 tons of beets per day. This factory proper can only slice 350 tons. It has three stations, or plants, each having a capacity for slicing and extracting the juice from about the same number of tons. This juice is limed and pumped to the main plant through pipe lines for distances ranging from 12 to 25 miles. The main plant evaporates the juice from all of them. This arrangement was necessitated by lack of railroad facilities to meet the requirements of these outlying districts. They have been in operation for several years and are considered so practical and valuable that when the company managing this plant built another at Sugar, Idaho, a slicing station was installed there.

It may be said the past season was the most favorable of any yet experienced by the factory. It had a large acreage, the tonnage of beets was heavy, the quality excellent.

Lewiston.—The Amalgamated Sugar Company is operating a factory here of 600 tons capacity. The past season was its second cam-

paign. Farms growing beets for this plant are watered by irrigation from Bear River. In this new district agricultural development has not proceeded sufficiently to keep a sugar factory running at its full capacity for a full campaign. Experience has demonstrated, however, that the soil is well adapted, the district is sufficiently watered, and that beets of high quality can be produced.

Before the establishment of this plant a large acreage had been grown in this vicinity for the plant at Logan. In the vicinity of the plant 1,750 acres of beets were grown last year. It had 1,310 acres in adjoining settlements. The total tonnage harvested was 31,000 tons.

Everything considered, the season was unusually favorable. The yield was large and the quality of the beets excellent. In the district producing beets for the factory the favorable results of this year are tending to a very much increased interest in beet production. A considerably larger acreage is anticipated for next year. The results of the past season have undoubtedly placed beet-sugar production higher in the estimation of the public.

Logan.—The Amalgamated Sugar Company has been operating a factory here of 600 tons capacity. As at Lehi and Ogden, the Logan plant required several years to place its working conditions on a solid basis. Last year the season at this place, as at the others, was the best experienced in the factory's history. About 4,500 acres of beets were planted. This was more than usual. The tonnage furnished this factory was large, the yield was heavy, and the beets were of excellent quality.

The operation of the plant at this place has not only served to build up for itself in its own locality permanent working conditions, but it has been the principal factor in establishing the same at Lewiston, where a plant was built a couple of years ago.

Ogden.—The Amalgamated Sugar Company is operating a plant at this place of 400 tons capacity. It has been very much improved with new equipment and the addition of new processes.

Previous to building this plant the district around Ogden was furnishing raw material for several canning factories. At first there was apparent conflict between these several industries. The ultimate effect was beneficial to all. It gave a stimulus to intensive production. In growing tomatoes and other things for canning, the farmers found it desirable to rotate their crops and grow sugar beets for the factory, and on the other hand beet growers resorted to the other crops. Together they have developed the farming district thoroughly in sustaining these manufacturing industries.

In common with the other factories of the State, it experienced the most favorable season in its history. A shortage of cars was the only difficulty occurring worth mentioning. The yield was larger,

and the quality of the beets was excellent. To both the factory management and farmers results this year were highly satisfactory. A fair acreage was planted. The stand on most of this was excellent. Under the favorable conditions prevalent in the district the yield was large and the campaign of the factory longer than for several years.

All pulp produced by this factory is consumed by local feeders.

WASHINGTON.

Sugar has been made from beets in the State of Washington for a number of years. Up to date most of the beets grown from which sugar is manufactured have come from districts producing crops under rain conditions. The progress of this factory has been slow, but from year to year the situation has grown more favorable. Beets grown in the State are usually of very high quality. On account of the tendency to drought, the tonnage has not been as high as in most sections of the country. For this reason the factory pays a higher price for its raw material than most other factories in the United States.

This State has been investigated very extensively in all its parts with a view to extending the beet-sugar industry. For cultivated crops some sections are dependent entirely upon irrigation. Many irrigation systems are being established, and in some cases the establishment of a beet-sugar factory appears to be the ultimate object.

Waverly.—The Washington State Sugar Company operates the sugar factory here. Its capacity is 500 tons of beets daily. On account of insufficiency of beets it has never been able to run a long campaign at its full capacity. The management has been very active in promoting the improvement of conditions. By adding additional railroad facilities, thus bringing new cultivated lands into use and reaching others recently put under irrigation, it is believed that the plant in future will be able to procure a competent supply of beets.

In the vicinity of this plant is operated the largest beet-seed-producing enterprise anywhere in the United States. In connection with this work the Department of Agriculture, through the Bureau of Plant Industry, has been cooperating in the production of high-grade beet seed, and has also been experimenting on the production of single-germ seed. Beet seed produced in this vicinity is of high quality and germinating power. The industry has not developed as yet sufficiently to affect the supply required in the country. Indications point to favorable results in the future.

During the early part of the growing season a period of drought covering a month and a half affected the crop to a considerable extent. The latter part was better. The yield was not heavy, but the quality was excellent.

WISCONSIN.

Beets have been grown and manufactured into sugar in this State for several years. The industry has had a peculiar history. Attempts were made in this State many years ago to manufacture sugar from beets, the result being a signal failure. The absolute lack of favorable conditions, aside from the soil conditions, may be assigned as the cause. Later a plant was built at Menomonee Falls, a large acreage of beets was grown for it, and a second failure was recorded. This was due entirely to the poor construction and equipment of the plant. Farmers growing the beets and capitalists who put their money into it were heavy losers. Experiments continued under the director of the State experiment station at Madison. From an experimental standpoint every indication was favorable. Wisconsin has developed extensive agricultural and commercial interests. It has the markets and the facilities to reach them; large dairy and live-stock interests, and large areas of cut-over timber lands, some of which have been reclaimed. These stump lands are cheap and available for further extending the sugar industry. These lands are fertile and cheap. They have all the natural conditions most favorable to root corps. Potatoes and turnips, ruta-bagas, mangel-wurzels, sugar beets, and everything of that description yield abundantly and are of high quality. The presence of dairies and the availability of these cheap lands all appeal to the establishment of some such industry as will encourage intensive features of agriculture.

A few years after the failure at Menomonee Falls a new company organized, bought the old plant, discarded its old machinery, and installed a new up-to-date equipment. A fair acreage was secured for the first campaign. This proved most satisfactory. The management has from year to year been increasing its acreage, improving its conditions for producing the beets, and working up interest among the farmers. Finally it built up a large beet-growing area. As a result of the favorable conditions developed by this company in other districts it has been necessary to install three other large sugar factories—at Janesville, Chippewa Falls, and Madison.

One of the principal things of interest to the industry occurring in this State during the past year was the effort made before the railroad rate commission by the sugar plants to secure a reduction of freight rates on raw material. An account of this matter is given in the following article, clipped from the Madison (Wis.) Journal of December 3, 1906:

A sweeping decision was rendered by the railroad rate commission this morning against the several railroads of the State declaring that the present rates on sugar beets and beet pulp are unreasonable, that the rules are unjust, and ordering a 20 per cent reduction in the rate of transportation.

The complaints of excessive rates were made by the Wisconsin Sugar Company, of Menomonee Falls; Rock County Sugar Company, of Janesville; and the Chippewa Sugar Company, of Chippewa Falls, against the Chicago and Northwestern; Chicago, Milwaukee and St. Paul; Minneapolis and Omaha; Wisconsin Central; and Illinois Central roads.

Several hearings have been held on the matter of rates. The minimum rate for the shipment of sugar beets for 25 miles or less was formerly 50 cents. The commission to-day reduced the rate to 40 cents per ton and placed the minimum on a carload of sugar beets at 30,000 pounds. The commission orders that the joint rate in any case shall not be more than 10 cents per ton greater than the regular rates fixed by the commission. The following rates were ordered:

	Per ton.		Per ton.
25 miles and under	$0.40	151 to 175 miles, inclusive	$1.20
26 to 50 miles, inclusive	.50	176 to 200 miles, inclusive	1.30
51 to 75 miles, inclusive	.65	201 to 225 miles, inclusive	1.40
76 to 100 miles, inclusive	.80	226 to 250 miles, inclusive	1.50
101 to 125 miles, inclusive	.95	251 to 276 miles, inclusive	1.60
126 to 160 miles, inclusive	1.10	276 to 300 miles, inclusive	1.70

The commission decided that the rules complained of regarding the minimum load required on every carload of beet product were unreasonable and unjust.

About half the beets worked by the factory at Menominee, Mich., are grown in Wisconsin.

J. D. Beck, labor commissioner, Madison, Wis., December 12, says:

The total output of the Menominee (Mich.) factory this year is estimated at 6,000 tons of sugar, of which 3,000 should be credited to Wisconsin beets. The output of the factory located at Madison will be about 2,800 tons of sugar; of the Menominee Falls factory 6,700; of the Janesville factory, 4,800, and of the Chippewa Falls factory, 4,500, making a total output for Wisconsin in 1906 of 21,000 tons of sugar.

Chippewa Falls.—The Chippewa Sugar Company has been operating a factory of 600 tons capacity here for two seasons. It is under the same management as that at Menominee Falls. A larger acreage was procured this year. The season was very favorable. For a new district results were highly satisfactory. In addition to the supply grown in this district, 2,000 tons of beets were purchased from the management of the Janesville factory.

Janesville.—The Rock County Sugar Company has been operating a factory here of 600 tons capacity. In the district tributary to it are grown about 10,000 acres of tobacco. At the outset tobacco interests were inclined to discourage beet production, but it was found that there was plenty of room for both; in fact, that each was a natural complement of the other. Both can be grown more profitably in rotation with each other. It gives two valuable intensive crops in a cycle of rotation.

Everything considered, the season was better than normal. The tonnage produced in the district for this factory was highly satis-

factory. The quality of the beets was not as high as in other years. Results are tending much to stimulate the industry in this vicinity. Prospects indicate that the plants in Wisconsin will secure all the acreage desired.

Madison.—The United States Sugar Company is operating a plant at this place of 600 tons capacity. The beet-growing area of this factory is also in that of a large tobacco-growing district. In culture and expense the tobacco crop more nearly approaches beets. Many of the old tobacco growers are taking to beet culture readily. As demonstrated in other districts in the State, beet growers will eventually take to the cultivation of tobacco as a suitable crop for rotation with beets. In this way the two crops will be mutually helpful.

A large acreage was secured for this factory. General results throughout the district were highly satisfactory. The season was up to normal. The yield of beets was good and the quality fair.

Menomonee Falls.—The Wisconsin Sugar Company is operating this factory of 500 tons capacity. It was the first successful plant established in the State. From its operations the installation of the others has been encouraged. The management of this plant in securing beets and encouraging the farmers to develop favorable conditions throughout the State may be considered a model in the work of the beet-sugar industry of the country. A large tonnage of beets was produced for it in its own immediate vicinity last year. It also received a considerable tonnage from other plants in the State, 5,000 tons having been purchased from the management of the Janesville factory.

Conditions of season and production were normal. On account of superior methods and adaptability to the work the farmers are accustomed to securing good yields and beets of excellent quality, and they were not disappointed the past season. The weather for planting and growing the crop was favorable up to the middle of July. From that time it was too dry to September 10. Rains commenced about the time the beets were ripening, reducing the sugar contents of the beets for a time.

All of the pulp produced by this factory is consumed very readily by the dairying and feeding interests in its immediate vicinity.

A new beet topper and puller was put into use in the district, and its work proved very satisfactory.

STATISTICS OF THE SUGAR INDUSTRY.

Under this heading I include (1) statistical data which I have gathered relating to the beet-sugar industry in the United States, and (2) statistics of the world's production of sugar (both cane and beet), as compiled and published by Willett and Gray.

STATISTICS OF THE BEET-SUGAR INDUSTRY IN THE UNITED STATES.

For the past year I offer (1) a table showing the acreage planted to beets in 1906, and (2) a table showing factory and farm results for 1906, with the totals and averages for the five preceding years appended for purposes of comparison.

ACREAGE PLANTED TO BEETS IN 1906.

The following table shows the acreage planted to sugar beets in 1906, by States:

Acreage planted to beets in 1906.

State.	Acres.	State.	Acres.
California	65,513	Wisconsin	16,650
Colorado	114,190	Nine other States having one factory each	39,928
Idaho	20,780		
Michigan	99,665		
Nebraska	15,201	Total	396,615
Utah	24,688		

Owing to unfavorable weather, mistakes of growers, neglect, and other causes, a part of the acreage planted is abandoned every year; but a comparison of the foregoing figures with the figures for acreage harvested, which appear in the general table, indicates that the acreage abandoned in 1906 was comparatively small—only a little over 5 per cent; in other words, the growers harvested about 95 acres out of every 100 planted. In Utah and Idaho almost all the acreage planted was harvested, while in Colorado and several of the less important producing States less than 3 per cent was abandoned.

GENERAL FACTORY AND FARM RESULTS.

The following table contains statistics of factory and farm results for 1906, with the averages and totals for the five years 1901–1905 appended in order to show the progress made:

General factory and farm results.

BY STATES, FOR 1906.

State and year.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.		Estimated average extraction of sugar.	Average sugar in beets.	Average purity coefficient of beets.	Average length of campaign.
					Pounds.	Tons.[a]				
		Acres.	*Tons.*[a]	*Tons.*[a]			*Per ct.*	*Per ct.*		*Days.*
California	8	60,141	11.17	671,571	185,480,000	92,740	13.81	16.7	82.7	115
Colorado	15	110,943	13.41	1,487,383	334,386,000	167,193	11.24	14.7	80.3	132
Idaho	4	19,950	11.48	229,023	56,798,000	28,399	12.40	16.9	86.8	95
Michigan	16	93,984	8.57	805,309	177,214,000	88,607	11.00	14.5	83.2	85
Nebraska	2	13,650	9.77	133,387	30,754,000	15,377	11.53	13.7	80.6	136
Utah	5	24,108	15.88	382,769	80,848,000	40,424	10.56	14.5	81.8	123
Wisconsin	4	15,560	10.19	158,600	35,220,000	17,610	11.10	13.6	83.0	83
States having but a single factory:[b] Arizona, Illinois, Kansas, Minnesota, Montana, New York, Ohio, Oregon, Washington.	9	37,738	9.75	368,070	66,524,000	33,262	9.04	14.4	81.2	86
Total and average[c]	63	376,074	11.26	4,236,112	967,224,000	483,612	11.42	14.9	82.2	105

TOTALS AND AVERAGES,[c] BY YEARS, FOR 1901–1905.[d]

		Acres.	*Tons.*[a]	*Tons.*[a]			*Per ct.*	*Per ct.*	*Per ct.*	*Days.*
1905	52	307,364	8.67	2,665,913	625,841,228	312,921	11.74	15.3	83.0	77
1904	48	197,784	10.47	2,071,539	484,226,430	242,113	11.69	15.3	83.1	78
1903	49	242,576	8.56	2,076,494	481,209,087	240,604	11.59	[e] 15.1	(*f*)	75
1902	41	[g] 216,400	8.76	1,895,812	436,811,685	218,406	11.52	[h] 14.6	[i] 83.3	94
1901	36	175,083	9.63	1,685,689	369,211,733	184,606	10.95	14.8	82.2	88
Averages 1901–1905	----	227,841	9.13	2,079,089	479,460,033	239,730	11.53	15.0	82.3	82

[a] Short tons—2,000 pounds.

[b] Grouped together to avoid giving publicity to the data of individual factories.

[c] The average yield of beets per acre is found by dividing the total beets worked by the total acreage; the average extraction, by dividing the total sugar produced by the total beets worked; the averages for sugar contents, purity coefficients, and length of campaigns, by adding the figures for each factory and dividing by the number of factories in operation.

[d] Compiled from reports on The Progress of the Beet-Sugar Industry in the United States for the years 1901 to 1905.

[e] This percentage represents data from only 14 out of 49 factories operating in 1903, no reports having been received from the others. The percentages of extraction reported by the other factories, however, indicate that this figure is probably too low rather than too high.

[f] Coefficients of purity were, unfortunately, not included in report for 1903.

[g] In the report for 1902 (p. 114) the statistics of "factory and farm results" contain data on acreage harvested for only 27 out of 41 factories in operation, the total for these being 166,127 acres. The total acreage for the year given here—216,400 acres—is the result of a carefully made estimate based on the total tonnage reported for the 14 factories not reporting acreage and the weighted average yield per acre of the 27 which reported acreage. The belief that this estimate is conservative is confirmed by comparison with the figure given by Willett and Gray for acreage in 1902.

[h] Represents 19 out of 41 factories in operation in 1902.

[i] Represents only 15 out of 41 factories in operation in 1902.

The data are given by individual States for all those States in which more than one factory is located; but the data for all the States (9 in number) having only one factory each are grouped together. This plan is adopted to avoid giving publicity to data concerning the operations of individual factories.

The striking feature of the results for 1906 is the immense gain made, the enormous stride taken by the beet-sugar industry. In nearly all respects the year has been a record breaker. When the figures are compared with the general averages for the preceding five years—1901–1905—it is seen that the acreage harvested in 1906 shows an increase of 65 per cent, while the tonnage of beets worked and the yield of sugar are more than double the five-year average.

NUMBER OF FACTORIES.

The first figure column shows the number of factories in operation, the largest number being in Michigan and the next in Colorado. The total number, 63, exceeds the number for 1905 by 11, and 3 new States were added to the list of sugar producers. The increase in number of factories over 1905 was 21 per cent.

ACREAGE HARVESTED.

The second column in the table shows the acreage of beets harvested. The total, 376,000 acres, exceeds that of 1905 by nearly 69,000 acres, or more than 22 per cent; is nearly double that of 1904, more than double that of 1901, and exceeds the five-year average by 65 per cent, as already stated.

Nearly all the States show an increase in acreage over that of 1905, the largest increases being 25,000 acres in Colorado, 16,000 in Michigan, and more than 8,000 in California.

YIELD OF BEETS PER ACRE.

The third column shows the average yield of sugar beets per acre. The average for the whole country was 11.26 tons per acre, the highest on record, exceeding that of 1905 by 2.6 tons and the five-year average by 2.13 tons, or 23⅓ per cent. This fine showing was due mainly to the favorable character of the growing season, but doubtless better cultural methods were a factor.

The highest yield per acre shown in the table is that of Utah, 15.88 tons, and the next highest that of Colorado, 13.41 tons. The greatest gain over the tonnage of 1905 is also shown in Utah, an increase of nearly 8 tons. Colorado shows an increase of more than 3 tons per acre, and Idaho and Wisconsin follow with gains of between 2 and 3 tons. The figures indicate that the yields were good

throughout the entire country, the lowest yield shown in the table—8.57 tons per acre in Michigan—being higher than the general average for the whole country in 1903.

TOTAL YIELDS OF BEETS.

The fourth column shows the tonnage of beets actually worked by the factories, and here again we see a great and gratifying increase, the gain over 1905 being more than 58 per cent, and over the five-year average (1901–1905) nearly 104 per cent.

The greatest increase in total tonnage over that of 1905 is that of Colorado, a gain of 612,000 tons, or 70 per cent. Utah shows an increase of 160,000 tons, or 72 per cent; Idaho a gain of 58 per cent, and Michigan a gain of nearly 52 per cent.

PRODUCTION OF BEET SUGAR.

The fifth column shows the production of sugar in pounds, and the sixth column the same in tons of 2,000 pounds. Compared with the production for 1905, these figures show an increase of nearly 55 per cent, and compared with the five-year average, an increase of nearly 102 per cent.

Idaho shows a gain in production of sugar over 1905 of more than 83 per cent, Colorado a gain of over 82 per cent, and Utah a gain of nearly 67 per cent.

CHARACTER OF THE BEETS.

The seventh and eighth columns show the percentage of sugar in the beets and the coefficient of purity. These figures are slightly lower than the figures for the best of the preceding years, but they are practically identical with the averages for the five years, 1901–1905. Lower sugar content and purity are usually expected to accompany heavy yields; consequently, in view of the large yields of beets in 1906, the character of the beets must be considered excellent. The beets grown in Idaho and Nebraska showed a considerable increase over those of 1905 in both sugar content and purity.

LENGTH OF CAMPAIGNS.

The ninth figure column in the general table shows the number of days the factories were in operation during the past season. The average length of campaigns for all the factories was 105 days, which was longer by 11 days than the highest previous record. It exceeded the average for 1905 by more than 36 per cent, and it was greater by 28 per cent than the average for the preceding five years.

In fact, the average for 1906 was 5 days longer than the assumed normal average of 100 days.

The large increase in the working periods of the factories was, of course, due almost entirely to the great beet crop they had to work upon. Campaigns below the normal had been the rule prior to last year, owing mainly to insufficient acreage.

SUGAR EXTRACTION.

The last column shows the percentage of refined sugar extracted, the basis being the weight of the beets worked. The difference between these percentages and the percentages of sugar in the beets represents the small amount of sugar left in the pulp and the much larger amount remaining in the molasses. This loss ranges from 2¼ to 4½ per cent of the weight of the beets with different factories, the average in different years varying from 3½ to nearly 4 per cent.

The percentage of extraction for 1906 was a little lower than the average for the five-year period. This decrease does not, however, indicate a lower efficiency in the factories, but is due to the heavy tonnage of beets.

COMPARISON BY SECTIONS.

If we compare the development of the beet-sugar industry in the far West, where the beets are grown mainly by irrigation, with that in the middle and eastern sections, where beets are grown by rainfall alone, it is apparent that its development in the West under irrigation has been far more rapid and extensive.

In 1906 the two States of California and Colorado alone, with 36 per cent of the factories, had over 45 per cent of the beet acreage, grew 51 per cent of the total tonnage, and produced over 53 per cent of the total beet sugar in the United States.

If we include with these two States the neighboring coast and mountain States of Oregon, Washington, Idaho, Utah, Montana, and Arizona—eight in all, or just one-half the beet-sugar producing States—we find that they have 57 per cent of all the factories, 61 per cent of the acreage, about 68 per cent of the beets, and nearly 71 per cent of the beet-sugar product of the United States.

If we include with these mountain and coast States Nebraska and Kansas, where irrigation is depended on to supplement rainfall in growing most of the beets, we have 10 States with 62 per cent of the factories, 66½ per cent of the acreage, 73 per cent of the total beets grown, and nearly 75 per cent of the beet sugar made in the United States.

A further examination of the figures given in the table of general results shows that the principal beet-growing States of the West have

the highest yields of beets per acre, beets with highest sugar contents and coefficients of purity, the longest factory campaigns, and the highest percentages of extraction in the factories.

It appears, therefore, that, on the whole, the Western States, where irrigation is practiced, are better adapted to the beet-sugar industry than the States farther east, where dependence for moisture is on rainfall only. The advantages of the West are, however, offset to some extent by the considerably lower cost of growing beets and by better markets and consequently higher prices for the product of the factories in the Middle and Eastern States.

VALUE OF PRODUCTS FOR 1906.

Some idea of the magnitude of the beet-sugar industry in the United States can be given by estimating the value of the beets sold by the growers to the factories and of the refined sugar placed on the market by the factories.

If we assume that the average price paid for beets in 1906 was $5 per ton, the total value of the 4,236,112 tons of beets harvested is $21,180,560. If we estimate the value of the sugar at 4½ cents per pound, the 967,224,000 pounds of sugar manufactured was worth $43,525,080. Probably the assumed prices both for beets and for sugar may be a trifle below those actually received, but these figures are sufficiently accurate to indicate the magnitude of the industry.

THE WORLD'S PRODUCTION OF SUGAR.

The following table shows the production of sugar in all the sugar-producing regions of the world for the years 1902–1906 inclusive. Two noteworthy features are (1) that the total production for 1906 is the highest on record, and (2) that the total production of beet sugar and of cane sugar are almost exactly equal.

Sugar production of the world.

[Prepared in the Division of Foreign Markets, Bureau of Statistics.]

Country.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
CANE SUGAR.					
United States:	*Tons.*[a]	*Tons.*[a]	*Tons.*[a]	*Tons.*[a]	*Tons.*[a]
Louisiana and Texas	329,226	234,800	350,000	342,000	243,000
Hawaii	391,062	328,103	380,576	383,225	390,000
Porto Rico	85,000	130,000	145,000	213,000	255,000
Total United States[b]	805,288	692,903	875,576	938,225	888,000
Cuba	998,878	1,040,228	1,163,258	1,178,749	1,250,000
Other West Indies	260,163	268,306	244,837	300,618	291,000
Mexico	112,679	107,547	107,038	107,529	115,000
Central America	21,500	21,450	19,768	18,516	19,000
South America	579,022	601,134	590,382	700,001	654,000
Total America	2,777,530	2,731,568	3,000,859	3,243,638	3,217,000
Asia	2,839,596	2,841,547	3,284,775	2,861,819	3,385,446
Africa	277,473	321,706	232,101	283,364	295,000
Oceania	133,126	163,328	216,213	230,000	249,000
Europe	28,000	28,000	18,592	14,512	15,000
Total cane-sugar production	6,055,725	6,086,149	6,752,540	6,633,333	7,161,446
BEET SUGAR.					
United States	195,463	208,135	209,722	283,717	[c]433,010
Canada	6,696	6,710	8,034	11,419	11,367
Total America	202,159	214,845	217,756	295,136	444,377
Europe:					
Germany	1,762,461	1,927,681	1,598,164	2,415,136	2,250,000
Austria-Hungary	1,057,692	1,167,959	889,373	1,509,870	1,335,000
France	833,210	804,308	622,422	1,089,684	755,000
Russia	1,256,311	1,206,907	953,626	968,000	1,450,000
Belgium	224,090	209,811	176,466	328,770	280,000
Netherlands	102,411	123,551	136,551	207,189	190,000
Other countries	325,082	441,116	332,098	415,000	440,000
Total Europe	5,561,257	5,881,333	4,708,700	6,933,649	6,700,000
Total beet-sugar production	5,763,416	6,096,178	4,926,456	7,228,785	7,144,377
Total cane and beet sugar production	11,819,141	12,182,327	11,678,996	13,862,118	14,305,823

[a] In long tons of 2,240 pounds, except in the case of European beet-sugar production, which has been retained in metric tons of 2,204.622 pounds, as originally estimated by Licht. Other data are mainly from Willett & Gray, but in the case of British India official estimates of production have been substituted.

[b] Not including the Philippine Islands, which are included under Asia.

[c] Equal to 484,971 short tons, or 1,359 tons greater than the production shown in table on page 104.

DEVELOPMENT OF CONDITIONS AND PROSPECTS FOR EXTENDING THE BEET-SUGAR INDUSTRY.

It may be stated that prospects for increasing the number of factories in the United States are somewhat peculiar. There never was a time since the inception of the industry when more communities were ready to embark in the beet-sugar industry. The farmers and business men are ready to sustain beet-sugar plants. On the other hand, capitalists are well advised concerning the availability of the proposed locations. From the standpoint of both the beet grower and the factory builder the tendencies to factory extension were never more pronounced.

Notwithstanding this situation, present indications point to fewer new factories for 1907 than were built during the past year. There are two main causes for this situation, and both are economic. The price of sugar during the 1906 campaigns of the sugar factories was very low. The market for the year has been somewhat erratic. In the western part of the country this has been caused largely by a change in the sugar refining which largely increased the output from the coast. Near San Francisco a new refinery was established under an arrangement with the Hawaiian planters. This controls most of the sugar coming from the Hawaiian Islands. In order to sustain the older refinery its managers brought in raw sugar from the West Indies and other places. This very much increased the amount of sugar coming from the west coast, brought on a stiff competition in the market, and affected the price of the beet sugar produced in the Rocky Mountain and coast States. It also affected materially the Missouri River markets, and consequently all beet sugar manufactured west of the Mississippi River. In the district west of the Mississippi are most of the places where the introduction of sugar factories is under contemplation. The probabilities are that the effect of the prevalent prices for sugar will only be temporary.

The second reason for hesitancy in factory building arises from some feeling of uncertainty regarding the permanence of the Government's present legislative policy as it affects this industry. Suffice it to say that conditions are ripe and popular feeling is strong for very much increasing the manufacture of beet sugar in this country whenever it appears reasonably certain that the present favorable policy of the Government is not likely to be disturbed.

There is no doubt that most of the well-established sugar factories are reasonably prosperous, but there is considerable significance in the term "well established." By it is meant the condition enjoyed by a factory having considerable experience and not hampered by unsolved problems; having a location where beet acreage can be secured readily, where the farmers are well versed in the methods of culture, where the soil normally produces a good yield of beets, where the by-products of the factory are consumed by the feeding interests, where intensive agriculture prevails, where the crop list of the district is conducive to rotation, where other industries thrive in cooperation with the sugar industry, where the freight rate is reasonable, where moisture through irrigation or rain is ample, and where regular markets and competent labor are available. Most of our sugar factories which have had five or six years' experience may be said to be well established. The favorable conditions are largely attributable to the factory's efforts. But it requires time to develop such conditions—longer under some circumstances than others. The difficulties are becoming less each year.

A few years ago "more beets" was the demand of the whole country. Last year there were only a few factories which did not secure the full acreage desired. The difficulty with a great number was overproduction. Such a condition tends to make the progress of the beet-sugar industry easy.

In my reports from time to time I have called attention to the greater tendency for the extension of the industry in the West. Everything considered, this is not due to superior facilities afforded. On account of the markets, transportation facilities, lesser cost of production, and many other things, the East has some advantages over the West. In the West there is more room to grow, less interference, and a united public demand for some strong industry capable of development work.

ARIZONA.

From time to time several valleys in this State have been tested experimentally in growing sugar beets. It may be said that the soils of these valleys as a rule are naturally adapted to the beet crop. The main difficulty with most of them is lack of railroads and incompetent irrigation, cropping here being dependent on irrigation.

At the present time there is one sugar factory in the State, an account of which has already been given. Until this factory shall have operated under more favorable auspices a further extension of the sugar industry in Arizona is somewhat doubtful, though during the past year another project was being considered near Phoenix.

CALIFORNIA.

The State is now actively engaged in beet-sugar production, standing second in amount produced.

Owing to the large amounts of sugar landed in the State for refining from outside sources, competition in the market is somewhat severe. This was especially true during the past season. In common with all other coast shipping interests, this industry is looking forward to the Panama Canal as a means of alleviating such conditions. It will affect the market for sugar and that of the other products in which it is used.

Two new factories were built in the State last year. Beets were grown for these under irrigation conditions. Most of the new districts under contemplation are also in irrigated districts. Beets are usually of high quality. Where sufficient water is available for irrigation and the land is properly handled and fertilized, the yields are good.

The following places in the State were under consideration the past season for establishment of new factories:

Compton.—At this place eastern parties were actively negotiating with home interests with a view to establishing a beet-sugar plant of

600 to 800 tons capacity. Plans contemplate both beet-sugar manufacturing and refining of Hawaiian raw sugar. In addition, the alcohol industry is under investigation as a subsidiary industry. Compton is south of and near Los Angeles and conveniently located for easy coast shipping and for the reception of raw sugar from Hawaii. It is in the vicinity of a well-established beet-growing district.

Marysville.—The district surrounding Marysville, on the Sacramento River, northeast of San Francisco, has been under active investigation during the past season by different interests. Plans contemplate a large acreage of land in connection with the plant. As yet nothing definite has been decided upon. Lands for growing beets would be watered by irrigation in connection with the Sacramento River.

Jacinto.—Jacinto is located in the vicinity of the lands growing beets for the factory at Hamilton. At this place a considerable acreage of beets was grown during the past year. Stimulated by favorable results, local interests are actively agitating for the establishment of a sugar factory at this place. They are negotiating with capitalists with this end in view.

Tehama.—During the past season beets were grown in this locality to some extent for the factory at Hamilton. The place is being more or less considered as an available point for a beet-sugar plant.

COLORADO.

An extended discussion of this State is unnecessary at this time. Beet growing for sugar factories is now carried on in most parts of the State. Where conducted to any considerable extent, favorable results are the rule. Progress in the installation of factories has been very rapid. Following the building of these plants has come a rapid development along agricultural lines. Many other industries have followed the establishment of the sugar industry. A number of canning factories, a plant for producing table sirup from beets, and several alfalfa-meal mills have been built and put in operation. The building of alfalfa-meal mills is under consideration at many points. The plants cost in the neighborhood of $50,000 each. In them alfalfa hay is ground into small particles. This product is compressed and shipped to the market in sacks, the same as bran. A demand for it is developing very rapidly in all parts of the country. Alfalfa is one of the main crops used in rotation with beets.

Notwithstanding the large number of factories already installed in the State, overproduction of beets was the rule. To meet this situation additional factories are under contemplation in districts which have grown large acreages of beets for established factories. Sugar manufacturers have been investigating and negotiating with local

interests. The farmers have either pledged the acreage or stand ready to contract for acreage sufficient to grow the beets. Indications point to a consummation of plans for building at the following places in 1907 or 1908:

BERTHOUD.—This place is in Larimer County in the beet-growing area tributary to Longmont and Loveland.

BOULDER.—Reporting on the conditions incident to the Boulder project, the secretary of the Boulder Commercial Association writes me as follows:

BOULDER, COLO., *December 31, 1906.*

DEAR SIR: Boulder County has been growing sugar beets for three or four years and keeping a 1,200-ton plant busy at Longmont in the eastern part of the county, but it was unable to grind all the beets contracted for this year, besides turning down 2,000 acres of contracts offered.

Boulder County has grown 71,800 tons of beets this year, the crop averaging between 15 and 17 tons per acre. Beets average 15 per cent of sugar and 80 in purity.

There are probably 10,000 or 11,000 acres of good sugar-beet land in the county. Our soil is mostly a sandy loam or sand and clay, very rich in potash and containing a good percentage of phosphoric acid. The source of irrigation is numerous mountain streams, furnishing abundant supply to store in reservoirs and conduct through the farming districts in large irrigation canals or ditches.

Yours, very truly, E. G. FINE, *Secretary.*

BRIGHTON.—Around this place beets have been grown for Longmont and Fort Collins. With reference to conditions and prospects for a sugar factory Mr. R. M. Barr, of La Salle, Colo., one of the company's special agricultural superintendents, reports as follows:

JANUARY 4, 1907.

DEAR SIR: I don't think there is a prospect of a factory this year, as this company does not intend to do any building this year, and there is no talk of building by any other company.

This past season there was about 700 acres of beets grown at this station, 450 for Greeley and 250 for a table-sirup mill built in 1906. We have grown beets for five years, and they are a profitable crop for both company and grower.

The tonnage of this station has averaged from 11 to 16 tons in the different years. Sugar contents and purity have come up to the requirements of the company on a contract requiring 15 per cent sugar and a purity of 80.

We have a variety of soils—sandy loam, black river bottom lands, heavy yellow and red clay lands—and all profitable beet-growing land if kept in a good state of fertility, which, with our Colorado alfalfa, can be easily done.

Yours, truly,

R. M. BARR, *La Salle, Colo.*

FLORENCE.—Beets have been grown in this district for the factory at Rocky Ford.

GREELEY.—Another factory is actively contemplated for this district.

JOHNSTOWN.—This place is located in Weld County, and the farmers have been growing beets extensively for near-by factories.

JULESBURG.—This place is in Sedgwick County, in the northeastern corner of the State. At this place a large irrigating ditch has just been completed, affording an abundance of water for irrigation. Beets have been grown for other factories in the State. A plant has been under contemplation at this place for several years and actively this year. During the past season about 1,300 acres were planted to beets, producing about 12,000 tons. These beets were shipped to other factories in the State. They tested 16 per cent of sugar, with purity coefficient of 82.

I have a recent report from Mr. J. Brant, a merchant of Julesburg, stating that announcement has been made of the purchase of a site for a factory and the signing of contracts for 5,000 acres of beets in 1907.

Mr. Mark Burke, a beet producer of this place, reports as follows:

JULESBURG, COLO., *December 29, 1906.*

DEAR SIR: Referring to your inquiry of December 24 relative to a beet-sugar factory at this place, I will say that we have a contract with responsible parties to build a factory in Julesburg to handle the 1907 crop of beets, and to begin construction of the same not later than February, 1907.

We have grown and harvested about 2,000 acres in 1906, which yielded from 10 to 18 tons per acre. We get $4.75 per ton (flat rate), so we do not know how much they tested; but we had a test made in 1904 that showed 18.1 per cent of sugar. We have 28,000 acres of land under reservoir irrigation.

Respectfully, yours, MARK BURKE.

LA JARA.—This is in the southern part of the State. A factory has long been under contemplation at this place. Referring to prospects and conditions at La Jara, Mr. D. E. Newcomb reports as follows:

LA JARA, COLO., *December 27, 1906.*

DEAR SIR: Experiments have been carried on in sugar-beet raising for a number of years. They have done well, yielding as high as 20 tons to the acre and testing from 16 to 18 per cent of sugar with purity ranging from 83 to 85. The only obstacle to contend with is that the beets will nearly all have to be siloed on account of our short seasons.

Our soil varies from a rich black loam on our river bottoms to a light sandy loam on our uplands. Our valley is about 100 miles long north and south by about 40 miles wide, and my judgment is that at least two-thirds of the valley will grow excellent sugar beets, or any other kind of roots. The valley is well watered from the Rio Grande River, Conejos, Alamosa, La Jara, and other streams. A reservoir on the Alamosa River is now under construction, which will cost, when finished, about $350,000. This will furnish water for about 30,000 acres. Two reservoirs on the Conejos and two on the Rio Grande will soon be under construction. Water and soil are all right.

Yours, very truly, D. E. NEWCOMB.

PLEASANT VALLEY.—This place is near Greeley and Longmont and has been growing beets for those factories.

PUEBLO.—Pueblo is on the Arkansas River. Beets have been grown in this district for the factory at Rocky Ford. A number of interests are closely investigating its conditions. Announcement has been made that a factory is to be constructed there in 1907.

I asked Mr. C. B. Schmidt to make a report on conditions at this place. Mr. Schmidt has been interested in a large body of land and actively investigating conditions in the vicinity for some time. He has been one of the chief workers for the introduction of the beet-sugar industry at this place. He reports as follows:

CHICAGO, *January 4, 1907.*

DEAR SIR: At Pueblo I had charge of a body of 20,000 acres of land irrigated from the Bessemer irrigating canal, and while there during the past twelve years have paid much attention to the beet-sugar industry in Colorado. Several years of experimental beet planting upon our lands eventually secured the erection of the first beet-sugar factory in the Arkansas Valley in Colorado. It was built by the American Beet Sugar Company, Henry T. Oxnard, president. The industry has developed to such an extent since 1899 that now 15 sugar factories are in operation in the State of Colorado, 5 of which are located in the Arkansas Valley between Pueblo and the Kansas State line, and a sixth is being built at Las Animas. There is also a prospect for a seventh factory to be built near Pueblo, but it may not be done before 1908.

The general average tonnage grown in the Arkansas Valley is 12 tons per acre, but good farmers reach 25 and even more than that. The factories pay a price of $5 per ton, flat—that is, irrespective of sugar contents. During the first five years since the establishment of the industry in the Arkansas Valley the factories paid for the beets on a sliding scale, to wit, $4 for beets testing from 12 to 14 per cent of sugar and one-third of a dollar more for each additional per cent. The growers, however, insisted upon a flat price, and the sugar manufacturers concluded that they could afford to pay $5 flat.

The beets grown in the Arkansas Valley in Colorado have averaged between 16 and 17 per cent of saccharine matter, with a coefficient of purity fluctuating between 80 and 90.

I think the lands which I had under my charge along the Bessemer irrigating ditch in Pueblo County compose the banner section for sugar beets in the Arkansas Valley.

Very truly, yours, C. B. SCHMIDT.

SALIDA.—With reference to conditions in the Salida district, Chaffee County, Mr. George S. Nelson, secretary of the board of trade, reports as follows:

SALIDA, COLO., *December 24, 1906.*

DEAR SIR: The board of trade distributed some 100 pounds of sugar-beet seed among a few of our farmers, but the results were not all that we expected, owing to various reasons, one of which was that they called for the beets just at a time when the ground was covered with a foot of snow, which was a bad thing for our showing. Also a want of care in cultivating gave our efforts a setback. We sent four samples of six beets each to the Grand Junction factory, and they registered as follows:

Results of beet growing near Salida, Colo., in 1906.

Sample.	Weight of beets.	Tare.	Sugar in beets.	Purity coefficient.
	Lb. oz.	*Per cent.*	*Per cent.*	
No. 1	1 13	12	15.4	79.5
No. 2	2 4	16	13.4	77.6
No. 3	2 4	13	13.7	77.2
No. 4	3 3	9	12.9	80.0

You will note that these beets are quite low in sugar and also in purity. I suppose that these beets were pulled right after the snowstorm. If that is the truth, that is one of the reasons for the poor quality, as wet weather will cause beets to drop in sugar and also in purity, but they will jump back again as soon as the ground dries out again.

We got no report on tonnage or cost of growing. We hope to do better next season. We think acreage could be assured for a factory, but have made no efforts in that direction as yet.

Very truly, yours, GEO. S. NELSON.

LAS ANIMAS.—At this place a factory of 700 tons capacity will be built. This plant will be constructed by the American Beet Sugar Company. The contract for its construction has been let. For some time beets have been grown for the factory at Rocky Ford and others near it more recently built. The establishment of a plant at this place will increase the number in the chain of factories along the Arkansas River to 6. The contract calls for its completion in time for the campaign of 1907.

OTHER POINTS.—In the newer parts, depending largely upon experimental data, the following places have been investigated, and indications point to the desirability of installing the beet-sugar industry in the near future: Argo, in Denver County; Durango, in La Plata County; Wellington, about 12 miles north of Greeley.

IDAHO.

At the present time Idaho has 4 sugar factories operating in the State, scattered along the Snake River from the western to the eastern part. These plants have given great impetus to agricultural development. There are several places in the State under serious consideration for building beet-sugar plants. It is anticipated that some of these projects will materialize in the near future.

During the past season factories in operation received a large tonnage and were worked to their capacity, the campaigns lasting from 80 to 120 days. The results of this season have done much to stimulate the industry in the State.

The State is developing very rapidly. Irrigation facilities, fruit culture, and the growing of alfalfa, small grain, and potatoes are extending rapidly. Indications point to the need of other sugar factories. The projectors of factories in Idaho are well advised of the needs of the industry. This experience was gained through a long, intimate acquaintance with it in Utah. There is no tendency to overdo the matter or overreach the capabilities of the State for sustaining the sugar industry. Factories will be built as fast as the business status will warrant.

PAYETTE.—When the factory was installed at Nampa by the Utah Sugar Company it entered into an arrangement with the business and farming interests of Payette. It was decided that the Payette district should grow beets in 1906 for the factory at Nampa, and as

soon as sufficient acreage could be procured around Payette another factory would be constructed there. During the past season around Payette was grown a large acreage, results of which were highly satisfactory to the farmers and to the factory management. Under this agreement, construction of a factory will commence in 1907, to be ready for the campaign of 1908.

ILLINOIS.

During the past season the interest of the beet-sugar industry in the State was centered around Rockford, Sterling, and Geneseo.

GENESEO.—At this point more interest has been manifested than at any other. In the town an active organization of business interests is promoting the beet-sugar project. It has been conducting negotiations with capitalists and beet-sugar men for the past two years. This place is located in one of the best-developed agricultural districts in the State. The soil is a dark sandy loam, and very productive. As a rule the farmers are of the better class. Under the direction of this organization considerable beets were grown in the district and shipped to sugar factories in Wisconsin and Illinois.

STERLING.—The editor of the Gazette, Sterling, Ill., reports to me with reference to the sugar industry at that place as follows:

STERLING, ILL., *December 24, 1906.*

DEAR SIR: There have been no definite steps taken in this section to develop the production of beet sugar. The tests made under the supervision of the State agricultural experiment station at Urbana some years since proved that this territory is well adapted to the growing of beets.

As I remember, there were 20 specimens of beets grown some four or five years ago in Whiteside, Lee, Carroll, Ogle, and Henry counties, half of which came from within a radius of 15 miles of this city. None of these analyzed less than 12 and some 15 per cent of sugar. One specimen I remember that was sent from the vicinity of Woosung, a village in Ogle County, a dozen miles north of the city, showed 18 per cent of sugar. The published report says that "it has been conclusively proven that this section is well adapted for the growth of beets for the manufacture of sugar."

We have a rich community, where land sells for $125 an acre, within 5 or 6 miles of the town. All of the roads are macadamized, and we have an abundant supply of excellent water and a surplus of water power practically developed. A Government canal (the Illinois and Mississippi) connects with the Illinois River and the coal-mining districts, which assures a low price for fuel. There is an excellent quality of lime within a few miles of the city on the bank of the river which could be transported in barges to a factory at a minimum of expense. The railways that enter the city cover the greater part of this county, and there are good connections with neighboring counties, where a considerable acreage should be secured.

The people here will take the matter up now, I think, if they have some encouragement. I think they would make an effort to secure the contracts for the necessary acreage and probably do something further to secure the location of a mill at this point.

Yours, most respectfully, E. S. HOOVER.

IOWA.

During several years many places in Iowa have been under discussion and investigation with a view to the introduction of the beet-sugar industry. At several points this subject evolved more than usual interest. Beets were grown experimentally, organizations were effected, local interests were canvassed, negotiations with capitalists and beet-sugar interests were actively conducted.

The districts which received particular attention were those around Des Moines, Davenport, Clinton, Waterloo, Fort Dodge, Cedar Falls, Mason City, Clear Lake, Muscatine, Missouri Valley, Sioux City, and Storm Lake.

For the factory at St. Louis Park, Minn., for the first few years considerable acreage was grown around Cedar Falls, Waterloo, and Storm Lake.

Near Missouri Valley for the first two or three years a large acreage was grown for the plant operated at Leavitt, Nebr. One season the contracts around this place reached 1,200 acres.

In addition to these practical demonstrations the State has been very thoroughly tested through small beet plats from year to year under the direction of the State experiment station at Ames. Through all these the conditions of the State have been pretty well ascertained. It may be said there is no district in the United States better adapted to this industry than the northern half of Iowa. It has many advantages. Commercially the field is very inviting to the beet-sugar industry. Railroads connect its cities and towns and penetrate its rural districts in every direction. There is not a county in the State without a railroad; many have several. Its sugar consumption is large. Natural conditions are as well adapted. Crops are regular and the soil productive. Dairying and stock feeding are largely developed. At present considerable interest in the subject is manifested at Fort Dodge.

Waverly.—Additional facts bearing on the State's adaptability to the industry will be more practically demonstrated by the actual results of a sugar factory. During the past season 1,200 acres of beets were contracted here for the factory at Chaska, Minn. The owners of that factory also have a plant at Bay City, Mich. It is one of the five originally established in a limited beet-growing district tributary to Bay City and Saginaw. It was found impossible to procure enough beets for all of them and the plant referred to remained idle for several years. Its owners made a proposition to the local interests at Waverly looking to its removal to that place. They stipulated that a certain acreage of beets be grown at Waverly in 1906 for the Minnesota plant; that 3,600 acres be contracted for by the farmers around Waverly for 1907 for a plant to be installed

there, and that Waverly capitalists invest a certain amount of capital in the stock of the new company. On these conditions the plant would be moved to Waverly.

The stipulated acreage for this year was grown around Waverly, and the results were exceptionally good. I examined the beet fields the latter part of June, and, for a first attempt, I never saw better beets at any other place in the United States. Contracts for 3,000 acres were procured as stipulated for the campaign of 1907. Contracts have been made for the removal of the Michigan plant to this place. Dismantling to that end is now proceeding. The foundations and railroad side tracks at Waverly were begun the first of the year. The factory will be installed and ready for the campaign of 1907.

Waverly is an exceptionally well-developed agricultural part of Iowa. Its farming element is composed of the industrious, frugal class. No better place could have been found for the introduction of the industry in the State. The Waverly factory is incorporated under the name of the Iowa Sugar Company, with a capitalization of $500,000. Its capacity will be 500 tons per day.

The work of promoting the industry at Waverly and growing the beets for the factory at Chaska, Minn., was under the active management of a local business men's committee. One of the active members of this, Mr. G. O. Van Derveer, reports on results the past year and the status of the sugar factory building at that place as follows:

WAVERLY, IOWA, *December 28, 1906.*

DEAR SIR: We have landed our beet sugar factory, and the contractors are now at work breaking ground. The contract has been let. The articles of incorporation have been executed and filed with the secretary of state.

In regard to growing beets, I will say that we had contracts for something like 1,200 acres this year, and the beets grown were shipped to Chaska, Minn. In all, 202 carloads, amounting to 10,474,720 pounds, were shipped. In general, I think the farmers were fairly well satisfied with the industry. Some, of course, had practically no beets at all, but the majority had 10, 12, and 14 tons per acre; one party had 24 tons, two had 22 tons, and a few more had 20. Of course these beets were all tested at Chaska, consequently we have no data as to sugar contents and purity. We have somewhere between 3,700 and 4,000 acres of beets contracted for now for the years 1907 and 1908, which of course assures the factory a fair campaign, and we have no doubt that when the Bremer County farmer becomes thoroughly acquainted with this industry and the profits therefrom he will take very kindly to the same.

During last summer there was not a man, woman, or child that wanted to work but had the opportunity to help in the beet fields, and that with the very small acreage we had planted the past year. The sugar people had several men here looking over conditions, soil, etc., and were well satisfied with them. They seem to think that Iowa—at least this section—is well adapted to raising sugar beets. In fact, Fort Dodge business men have run an excursion to

Waverly to investigate the beet industry, with a view to securing the second factory which the eastern parties connected with our company have said will be built in Iowa.

Yours, very truly, G. O. VAN DERVEER.

KANSAS.

Experimentally beets have been grown in Kansas for a number of years. As a result of these tests its general conditions have been considered rather unfavorable. In this State, as in Nebraska, are two distinct conditions in relation to farming. In the eastern half crops are grown by rainfall, but the amount of precipitation gradually declines from east to west, the western portion being semi-arid. Crops depending upon rain are not so sure. Conditions are similar to those in eastern Colorado, where irrigation is necessary.

In this western section beets grown experimentally, or as regular field crops for sugar factories in eastern Colorado, have proven of high quality. Where proper cultivation is given and sufficient water is obtained the yield is generally good.

The district giving most attention to the beet-sugar industry for the last few years are the lands tributary for irrigation purposes to the Arkansas River. The adaptability of these lands for beet culture has been thoroughly established. Under the encouragement of a State bounty, a considerable tonnage of beets has been grown from year to year for the factory at Rocky Ford, Colo.

During the past season Colorado capitalists established a factory in the western part of the State, at Garden City, very much increasing this year the acreage grown in that section. Results were highly satisfactory. In connection with the plant the company owns about 27,000 acres. It plans to utilize this entire acreage in sugar-beet production and crops grown in rotation therewith. It has announced the policy of building three other factories in the vicinity of the first one, drawing upon its owns lands for its acreage, and upon other lands watered from the Arkansas River. It has already built up a competent beet-growing area in the vicinity of its present factory. The other factories will be needed in the next two years. These plants will be in the vicinity of Garden City, Deerfield, and Lakin.

In beet culture the experience of western Kansas is that of other places. More experience develops an upward tendency in yield and profits. I quote from a recent report of Hon. F. D. Coburn, secretary of the Kansas State board of agriculture, as follows:

In 1901 the average profit per acre was reported at $28.48, while the highest individual profit per acre was $43. In 1904 one grower in Rawlins County, during his first year, reported profits of $85.50 per acre. In showing the increase in tonnage it may be stated that in 1901 the average yield per acre was 5.10 tons; in 1902 it was 9.68 tons, an increase of over 90 per cent. The 1903

crop was practically a failure, owing to a spring freeze. In 1904 the average yield per acre was 13.51 tons, an increase over that of 1902 of about 40 per cent, and more than 160 per cent over that of 1901; and in 1905 there was a creditable tonnage per acre.

The above averages were obtained where the acreage was small. The results of the past season furnish a better test, as they show averages from the entire campaign, in which 70,000 tons of beets were worked. The average of the sugar contents was 16 per cent, the average purity 84, the average tonnage per acre 11⅔. This indicates superb conditions for the factory, and that the average farmer growing the beets received $58.33 gross per acre.

In his report issued in September, 1906, Secretary Coburn estimates the cost of growing beets in Kansas as follows:

Cost of growing beets in Kansas.

	Per acre.
Plowing	$1.00
Seed, 20 pounds	2.00
Planting	.50
Bunching and thinning	6.00
Hoeing and cultivating	10.00
Harvesting and topping	8.50
Interest on land, irrigation, hauling, general charges	9.50
Total	37.50

This estimated cost per acre, $37.50, is about the ordinary cost of producing sugar beets in any well-regulated irrigation district. Using this cost factor, the average farmer growing beets for the Garden City factory this season received $20.83 net profit per acre. If such results as these can be achieved in western Kansas the first year, sugar production certainly appears to have a bright future.

The average sugar content and purity of the beets maintained in this district the past season throughout the campaign is certainly very flattering to the district. The reception of 70,000 tons by it the first year augurs much for the future of the industry in that section of the State. The factory management and the farmers growing the beets appreciate this. Every indication points to the building of one of these sugar factories in 1907 and the other two in the near future.

MINNESOTA.

During the past summer there has been considerable agitation in favor of building more sugar factories in the State. Several years' experience in the industry has developed many conditions favoring it. The soil is especially adapted. As a rule it is a sandy loam, quick and responsive, and adapted to a low cost of beet culture. It has an abundance of pure water in its running streams and lakes. It has transportation lines and markets. These conditions are appreciated generally by the business and farming interests of the State.

In almost any part of the State where lands are cultivated beets of sufficient quantity and quality can be grown. The lower half of the State is better adapted for manufacturing.

The places receiving special attention as possible locations of beet-sugar factories were Watkins, Austin, and Winona. All of these places are very favorably located for manufacturing and shipping purposes. They are in the midst of fertile, well-developed, progressive farming districts.

MONTANA.

In my reports for several years I have discussed conditions adapted to the beet-sugar industry in this State. Throughout its valleys many experiments have been conducted from time to time. It has been under investigation by beet-sugar capitalists of Colorado and Utah. All are agreed that its natural conditions are especially favorable to the sugar industry.

This industry is destined to play an important part in the State, as it has already done in Colorado. Its installation simply awaits the development of conditions—the irrigating ditch, the railroad, reclamation of the soil, and the presence of the settler.

Recently irrigating facilities were very much increased in the vicinity of Billings, and a sugar factory was built.

There is a number of valleys in the State in which improvements are proceeding very rapidly, more land is being reclaimed, and the country is fast settling. Representatives of beet-sugar interests have had these places under investigation and are encouraging improvements. Sugar factories are definitely under consideration. Local interests are ready to furnish the acreage; beet-sugar companies are ready to build the factories. Local companies or organizations have the matter definitely in hand.

Those places more generally spoken of are Conrad, in Teton County, a farming district irrigated from the Marias River; Fergus, in the upper part of Fergus County, in the central part of the State, near the Missouri River; Harlem, Chinook, and Montauk, in the Milk River Valley, in Chouteau County, and Hamilton, in the valley of the Bitter Root River, in Ravalli County. All have been under serious consideration, and negotiation has been going on between those locally interested and representatives of companies producing sugar in Colorado, Michigan, and Utah.

With reference to conditions around Chinook and prospects of a sugar factory there, I publish a report made by Mr. L. V. Bogy as follows:

CHINOOK, MONT., *December 27, 1906.*

DEAR SIR: This community is very much interested in the sugar-beet industry. The past season our commercial club offered prizes for the first, second, and third best quarter acres of sugar beets grown in this vicinity. A number of

farmers competed, and analyses showed as high as 20 per cent of sugar and 88 coefficient of purity, and the tonnage ran as high as 24 tons per acre. The average was about 17½ per cent of sugar and 85 purity. Yields averaged 18 tons per acre. The cost of growing per acre was about $40.

We have a Sugar-Beet Growers' Association organized and incorporated for the purpose of taking up the matter with proper parties, with a view to getting a beet-sugar factory located here. From all data we can gather, we believe there is no more favored spot in the United States than this for the successful culture of the sugar beet. Our soil seems to be particularly adapted for growing beets high in sugar content and purity and with large yields. We are taking the question up in earnest, and, while we have quite a large acreage secured for sugar beets, we expect to add to it very materially and believe we will be in shape for a factory to work the 1908 crop of beets into sugar.

Yours, respectfully,

L. V. Bogy.

With reference to conditions around Harlem and the prospects of building a sugar factory there, I publish a report made by Mr. W. E. French, secretary of the Milk River Sugar-Beet Association, as follows:

Harlem, Mont., *December 30, 1906.*

Dear Sir: Referring to the sugar-beet industry, I beg to state that we are at work at the present time securing subscribers to contracts for the purpose of securing a factory in 1908. Milk River Valley is adapted to beet culture, the soil being rich sandy loam. We are negotiating with the Amalgamated Sugar Company, of Ogden, Utah, for the establishment of a factory as soon as we have the acreage signed up.

Fort Belknap Reservation is in the heart of Milk River Valley, and we have one of the best sections of the United States for sugar-beet culture.

Respectfully, yours,

W. E. French.

Bozeman.—Bozeman is in Gallatin County. Its cultivated lands are in Gallatin Valley. At this place is located the State Agricultural College and Experiment Station. This district has been thoroughly tested by the experiment station for a number of years. Results have always indicated good yields and beets of a high quality.

This point had been in favor for the location of a factory for some time, even before one was located at Billings. In this district were grown beets during the past season for the Billings factory farther east. This small place raised $28,000 for the purpose of promoting the beet-sugar industry. It has purchased a site of 140 acres; it has the right of way for a switch, and has secured contracts with the farmers for over 5,000 acres of beets. It has an agreement with the Amalgamated Sugar Company to build a factory at this point upon the completion of these conditions. Farmers' contracts were based upon the factory's guaranty of sufficient labor in the fields. Upon this now depends building of the factory in 1907.

In order to furnish some information relative to conditions and prospects at Bozeman, I wrote Hon. C. S. Hartman, of that place,

who is prominently connected with the citizens' organization for establishing a beet-sugar factory. In response I received the following:

BOZEMAN, MONT., *December 27, 1907.*

* * * We have been working earnestly to secure a sugar factory here at Bozeman for the past year, having already secured contracts for over 5,000 acres signed by the farmers of our valley. We expected to have the matter settled in regard to the building of the factory before this, but at present we are more in the dark than ever. In answer to your question—"To what extent have you experimented or practically grown sugar beets?"—I will say that we have been experimenting with sugar beets here in the Gallatin Valley for the past fifteen years, and this year there was quite an acreage grown and shipped to Billings, some farmers growing as high as 15 acres. The results have been highly satisfactory. We are confident that we can raise as good a beet and as large a tonnage as they can in any place in the United States. The tonnage will run from 15 to 25 tons per acre, the sugar contents from 15 to 18 per cent, and the purity from 80 to 90.

We have here in the Gallatin Valley something like 120,000 acres under irrigation and about an equal area is farmed dry. The nature of the soil varies from heavy black to very light sandy. In fact, I think we have the greatest variety of soil of any valley in the Northwest, plenty of water, and an irrigation system that is unsurpassed, which has been developed and handled by men thoroughly experienced in that line of farming.

Respectfully, C. S. HARTMAN.

In reference to the status at Bozeman, I publish a report made by President J. M. Hamilton, of the State agricultural college, located at that place:

BOZEMAN, MONT., *January 8, 1907.*

DEAR SIR: In answer to your inquiry about the Bozeman beet-sugar factory I will say that contracts were secured with the farmers for 5,000 acres of beets. Arrangements were made with the Amalgamated Sugar Company, of Utah, to erect a factory during the year of 1907. The contracts with the farmers required the factory to guarantee labor. This they have been unable to do so far, and now it looks as though the factory would be delayed. The capital is ready, but the labor is lacking.

Our experiment station has been sending out seeds and analyzing beets for some ten years with very flattering results. Nothing has been published of the work for the past three years.

The Gallatin Valley has about 100,000 acres of first-class land, mostly sandy loam, under irrigation. It is the best watered valley in the State of Montana, being surrounded by high mountains covered all the year with snow. Most of our streams have their sources near the Yellowstone National Park.

Yours, truly,

J. M. HAMILTON.

NEBRASKA.

At the present time there is very little consideration given to installing sugar factories in the eastern part of the State. In this section there are now two sugar factories and the bulk of the beets for both come from the western part of the State.

In the last few years facilities for irrigation have greatly developed. The ditches connect with the North and South Platte and the Republican rivers. In this irrigation section of the State about 11,000 acres were planted last year, the principal acreage being around North Platte, in Lincoln County, and McCook, in Redwillow County. There has been considerable negotiation between parties locally interested and the managements of the two established factories in the State regarding the building of plants at these points. Irrigation facilities are rapidly extending. The districts produce sugar beets, alfalfa, small grain, and potatoes. If factories were to locate here, the beet-growing area would be very much extended. It is over 100 miles from Grand Island and over 200 miles from Leavitt. If it pays to produce this raw material and ship it so far to these factories, the beet-sugar industry would certainly be working at a greater advantage if located in this large, fully developed beet-growing district. For absolute assurance of moisture here, irrigation is necessary. During the past two years this district has received nearly enough rainfall for growing crops, requiring very little irrigation. There will be other seasons, no doubt, of which this can not be said.

The management of the factory at Leavitt had an agreement with the business men and the farmers of the North Platte area to build a factory here during 1906. Had not this company fallen into difficulties, leading to a receivership, a sugar factory would undoubtedly have been installed here the past season. The district has been investigated by others. There is every indication that either one of the present companies operating in Nebraska or some outside company will build a factory at North Platte soon.

The other places that have been under investigation for several seasons are McCook and Culbertson, on the Republican River, in Red Willow and Hitchcock counties, in the southern part of the State. Around these points are grazed many sheep and cattle, and considerable alfalfa is grown for feeding and grinding into "alfalfa meal."

OHIO.

The factory in operation at Fremont has done much to promote this industry's progress in Ohio. The beet-growing area in its vicinity during the past season greatly overran the capacity of the factory. The plant at Blissfield, Mich., near the southern border of Michigan, receives many beets grown in its vicinity in Ohio. The two have built up conditions necessitating an additional factory. Defiance has been under consideration for this purpose. The management of the factories at Blissfield, Mich., and Fremont, Ohio, have under consideration plans for the establishment of a plant at

Defiance. With reference to the conditions and prospects here, I publish a report made by J. J. Thieroff, as follows:

DEFIANCE, OHIO, *January 7, 1907.*

DEAR SIR: As regards the building of a sugar factory here, we don't know any more about it than we did last summer when you were here. As to the practicability of growing sugar beets in this section, this has been our first season in Defiance and Paulding counties and also the eastern part of Allen County, Ind., except that about eight or nine years ago some beets were grown in an experimental way for the United States Department of Agriculture.

As to yield, we had a very unfavorable season to contend with. In the spring in the greater part of Defiance County we had a severe drought. We had a hard time getting the soil in such shape that it was possible to plant, and then the continued drought hindered the beets from sprouting. The dry spell was not broken until July 3, and the result was that a large portion of the seed did not come up until after the 4th of July and considerable of the area had to be replanted.

The above has reference to Defiance County generally. In Paulding and Allen counties the weather conditions were more favorable. They had a greater rainfall. The tonnage per acre in the last-named counties ran all the way from 12 to 18 tons per acre, while in Defiance County it will be, on an average, about 11 tons. At harvest we had but very little sunshine and lots of rain, which very much decreased the percentage of sugar, so it will run about 13 per cent and the purity about 83.

Our soil is mostly the so-called "elm soil;" we have a large area of it, and there is surely no question that in a favorable season we can grow a large crop of beets and of good quality. Under the unfavorable weather conditions the past season we have grown a very profitable crop.

Yours, very truly, J. J. THIEROFF.

UTAH.

There are two or three places in Utah at present where conditions are sufficiently matured to sustain sugar plants. The Lehi factory has developed a considerable acreage of beets in Sanpete and Sevier counties. Should a factory be located in each of these counties there is ample area already developed to sustain them. For some time farmers and business men of this southern district have been in negotiation with the management of the plant at Lehi and other beet-sugar interests for the purpose of securing a factory. The Utah Sugar Company has had the matter under advisement for some time. It has announced that the company will build at least one factory to accommodate this territory somewhere near the boundary line. Propositions have been received from other interests to the same end.

The points considered in this district are Gunnison, of Sanpete County, and Richfield and Elsinore, of Sevier County. Water for irrigation in these two counties is received from the Sevier River.

North of Salt Lake there is a large irrigated district watered from Bear River. Beets are grown here for the three factories at Garland, Logan, and Lewiston. Beet culture has developed to such an extent that another factory is demanded here. One is under active consid-

eration near Trenton. Business and farming interests in this community are assured that a factory will be built as soon as sufficient acreage can be signed up. This is in the northwestern part of Cache County. A new irrigating ditch has just been opened up developing about 30,000 acres of land. A sugar factory in this northern district and one or two in the southern part of Utah are anticipated soon.

WASHINGTON.

For several years there has been considerable agitation tending to further increase the number of sugar plants in Washington. Most places recently considered are in the irrigated districts, principally those watered from the Yakima River. For the plant now in operation at Waverly beets are grown, as a rule, under rainfall. The principal rainfall in eastern Washington comes in the winter and early spring. This is found sufficient for small-grain production. The growing period of sugar beets is longer. It is found, through experience in growing beets for this factory, that the rainfall is hardly sufficient for beets. There is too much tendency to drought in July and August. Often the tonnage is cut materially on this account.

It has appeared likely several times that a plant would be established at North Yakima. Around this place has developed an extensive agricultural and fruit-growing district, amply watered by irrigation. The soil is productive and beets of a high quality are produced. Up to the present time most of the projects have fallen down for lack of capital.

North of this, on the Yakima River, in Kittitas County, during the past season, Ellensburg has been under serious consideration by capitalists of Seattle. The proposition was made to those locally interested to establish a plant at this place, providing sufficient acreage could be contracted. For a while this project appeared very probable. It is still under consideration. The locality has conditions well adapted to the sugar industry.

With reference to the prospects for a sugar factory, development work, and conditions at Ellensburg, I publish a report including analytical data regarding beets grown there during the past season:

ELLENSBURG, WASH., *December 31, 1906.*

DEAR SIR: We feel sure of ultimately getting a sugar factory located here, and hope to have it built within the next year or two. We have raised sugar beets for the past two years, with most gratifying results as regards tonnage, sugar content, and purity. I inclose herewith report of tests made by the chemist of the State agricultural college on beets raised during the year 1906. I have not a report of tonnage at hand, but the average yield for both years runs about 20 tons per acre. We have in this valley about 80,000 acres of irrigated land suitable for raising sugar beets. Most of this land has abundant water for irrigating purposes. Conditions as regards markets and for obtaining labor are ideal.

Ellensburg is situated about 125 miles from Seattle, the best market on the Pacific coast north of San Francisco. We have no labor organizations to interfere with the importing of suitable help for weeding and thinning beets.

Respectfully,

C. W. JOHNSONE.

Results of tests of sugar beets at Ellensburg, November 30 and December 1, 1906.

Grower.	Sugar in beets.	Purity coefficient.	Grower.	Sugar in beets.	Purity coefficient.
	Per cent.			*Per cent.*	
Dallas Kinkade	14.1	83.2	Josie Stevens	17.1	91.3
Ben Rader	23.6	93.5	Guy Dunning	16.6	85.3
May Stevens	17.7	90.0	Harry Rice	14.1	81.1
Sylvan Thomas	17.5	88.5	Ina Van Nostran	15.4	90.0
Maud Stevens	17.6	87.3	Jeff Fortney	18.3	89.3
Jesse Newman	16.6	89.9	George Page	20.8	93.3
Rua Beail	19.7	90.8	Cora Jonas	18.5	90.7
Cecil Hutchinson	16.6	86.1	Horace Briggs	19.4	90.7
Raymond Kellicut	20.5	90.0	Selena Preece	17.5	85.0
Millie Van Nostran	17.6	88.9	Mary Preece	15.6	82.0
Marshall Malone	21.2	92.1	Iris Burns	18.0	85.9
Bob Ballard	23.6	93.5	Vida Bollman	17.9	84.3
Winnie Mudd	17.5	89.3	Mack Reece	15.1	84.6
Willard Sheldon	16.8	88.5	Harry Hayes	16.9	87.6
Hazel Berry	17.8	87.0	John Sorenson	16.0	84.0
Clara Sheldon	19.4	86.8	Charles Indemuhle	15.6	86.3
Sadie Mudd	13.9	77.2	Dora Hayes	17.7	84.5
Jessie Mudd	17.0	84.4	Bertha Sorenson	16.7	83.0
Dorothea Sorenson	17.0	85.3	Milo Sheldon	17.9	84.7
Flora Preece	13.7	73.3	Willie Cheney	16.2	90.5
Ruth Barkley	16.6	85.2	Chalmer Cobain	20.9	90.0
Beckwith Hubbell	18.2	87.6	Mabel Ames	20.2	89.0
John Pieroth	17.9	86.2	Helen Barkley	18.1	86.4
Frederick Munz	17.0	85.2			
Ida Anderson	18.4	84.7	Average	17.6	85.3
August Hartman	17.8	89.0			

WISCONSIN.

Wisconsin has many conditions which admirably adapt it to the sugar industry, which is gradually developing in the State. Four large factories are now in operation. In the State are many lakes, springs, and running streams of the purest water. It is one of the best developed States in intensive agriculture. Its dairying and creamery interests are quite extensive. It has canning and other interests depending upon the farm for raw product. It grows considerable tobacco. It has an intelligent, progressive farming population; cheap, abundant transportation facilities, both by water and by railroads, and has many places admirably adapted to the beet-sugar industry.

As fast as conditions will warrant, other factories will be built in Wisconsin. The places under consideration at the present time are Green Bay, Edgerton, Lancaster, Marshfield, Sturgeon Bay, Fond du Lac, and Prairie du Chien.

Below I give a report by E. C. Amann on conditions and prospects of the beet-sugar industry at Prairie du Chien, Wis.:

PRAIRIE DU CHIEN, WIS., *December 29, 1906.*

DEAR SIR: As we have not received the complete returns we are unable to give you the complete details concerning the beets grown by this association.

We expect by January 20 to be able to give you the details. We have already enough to pay all expenses, and we think that we ought to receive a profit of about $1,000. We had a larger acreage than any other grower in the State. Our sugar test ran from 12 to 15½ per cent, and we think the yield will average about 15 tons per acre.

It has been intimated to us that the United States Sugar Company, of Madison, is contemplating the erection of a factory here in 1908.

Very truly,

BEET GROWERS' ASSOCIATION,
Per E. C. AMANN.

WYOMING.

Wyoming's conditions, natural and commercial, are quite similar to those of Montana, but it is newer and less developed. What it needs is railroads, irrigation, settlement, and soil development. It has many running streams draining its mountains, carrying the melted snows and early rains, and many fertile valleys tributary to these streams. Irrigation is proceeding very fast to their development. At present the irrigation is largely conducted by means of running water. In the mountains in the western part of this State are collected the snowfalls of winter and the rainfalls of spring. The future will see these impounded and gradually conducted to the soil as needed, greatly promoting and extending the agricultural resources of the State.

As in other mountain States, the soils of Wyoming produce in abundance many field crops, principally alfalfa, potatoes, and small grain. Grazing is the principal feature of its stock interests. Experimentally its valleys have been tested for adaptability to beet culture. Under proper methods of culture, with sufficient water, the yield is heavy and the quality is excellent.

Realizing the part the sugar factory has played in the development of Colorado, every valley in the State of Wyoming susceptible to cultivation and cropping has been under investigation. Irrigating and railroad projects tapping its fertile valleys are contemplated or projected. Capitalists from all parts of the country have inspected these valleys. Managements of great railroad lines have become interested. Men interested in the beet-sugar industries of Utah, Colorado, and Michigan have participated.

Back of all these projects of irrigation, railroad building, and town sites is the sugar factory. Some of these factory projects are almost to the point of materialization. Capitalists have made actual propositions to build factories. Local organizations have accepted, or are actively striving to meet the conditions imposed. Of such are the projects contemplated for Sheridan, in Sheridan County, Tongue River Valley: Worland and Lovell, in the Big Horn Valley, Big

Horn County. Other places under consideration to a considerable extent are Burlington and Cowley.

With reference to conditions and prospects of the beet-sugar industry at Sheridan, I publish a report made to me by Mr. W. S. Metz:

SHERIDAN, WYO., *December 28, 1906.*

DEAR SIR: We have all the arrangements under way for the installation of a sugar factory. The beet-sugar people from Colorado Springs have purchased a large tract of land contiguous to the town of Sheridan suitable for the cultivation of sugar beets. They are contracting for a site for the factory and have taken a franchise for an electric railway through the town of Sheridan and through the lands adjacent to the town that will be cultivated to sugar beets.

We have in this county at the present time probably 150,000 acres of land, all of which is suitable for beet culture and at present is in cultivation and under irrigation. We have a natural water supply sufficient to irrigate more than this amount of land. The reservoirs which are now in process of construction will irrigate at least 100,000 more acres.

Our soil is a sandy loam, and our climate, having a great degree of sunshine during the crop season and an abundance of water for irrigation, gives us the ideal country for the production of sugar through sugar-beet raising; and the experiments that we have made show an average of from 18 to 23 per cent of saccharine matter, which percentage is greater than the average in the best fields in the State of Colorado. There is no reason why this industry should not be successful here.

Yours, truly, W. S. METZ.

Nature has done a great deal toward preparing the State for the sugar industry. Investigation reveals great mines of cheap coal, deposits of fuel oil, and natural gas. As in Utah and Colorado, along its streams exist conditions for natural water power.

SOUTH DAKOTA.

At Belle Fourche, S. Dak., the Reclamation Service is installing an irrigating project. Sugar beets have been the favored crop under consideration for utilizing the lands reclaimed. During the past season they were grown in this district experimentally. I publish a report made with reference to this point, giving results of experimentation with beets by the engineer in charge of the irrigation reclamation work:

BELLE FOURCHE, S. DAK., *December 28, 1906.*

DEAR SIR: It is probable that a beet-sugar factory will be built under this project in the near future, and several parties are figuring on the same at this time. Two of the parties furnished sugar-beet seed from Germany for planting for experiments last spring, and about 20 farmers in this vicinity grew beets from this seed, although I will say they were not given proper care and cultivation. If they had, the percentage of sugar would have reached a much higher mark. The stands were all first class, I think, none of the yields being less than 20 tons per acre, although such a small amount was grown by each one that it was hard to estimate the exact tonnage.

I send you herewith a sheet showing result of analyses of sugar beets grown, which may be of interest to you and which you may use if you desire.

Some effort is being made by the residents of Belle Fourche to secure a factory, but nothing definite has yet been done. As soon as the Belle Fourche project, which will reclaim 100,000 acres of land east of Belle Fourche, is completed, there is no doubt that two or three factories will be started in that area. Any further information you may desire I would be glad to furnish.

Very truly, yours,

R. F. WALTER, *Engineer in Charge.*

Analyses of sugar beets grown on or near the Belle Fourche project, one set of samples being sent on September 20 and the other October 20, 1906.

Grower.	Sugar contents of beets tested Sept. 20.	Sugar contents of beets tested Oct. 20.
	Per cent.	*Per cent.*
J. M. Eaton	11.95	17.1
L. J. Townsend	9.2	11.2
Chas. Shroyer	13.2	.....
B. Kemper	12.4	14.7
G. M. Fish	13.2	.....
C. Shipley	12.3	.....
Tom Eaton	11.3	.....
John McClure	12.1	16.1
J. W. Haines	12.1	16.8
H. C. Shreyer	11.4	.....
W. M. Matthews	12.6	.....
T. Brennan	12.6	.....
A. T. Adams	10.9	14.5
United States Reclamation Service	14.3	16.6
R. H. Evans	.....	12.7

OTHER STATES.

There has been more or less consideration given to building sugar factories in other States. A factory has been considered to some extent for Caledonia, N. Y. This point has grown beets for some time for the factory at Lyons. Its consideration at this time is due to the development work incident to this factory.

Parties owning a large body of land at Springer, N. Mex., have been considering the installation of a sugar factory to develop and utilize these lands.

During the past season considerable attention was given to the sugar industry in one or two places in Oklahoma and at Muscogee, Ind. T.; also at Sault Ste. Marie, Mich., and in a district in Cook County, central Oregon.

WORK OF THE BUREAU OF PLANT INDUSTRY.

B. T. Galloway, Chief.

SCOPE OF THE WORK.

The studies and investigations which the Bureau is making in connection with sugar beets include the following: Studies of the effects of fertilizers, of cultural methods, of methods of siloing, and of the various diseases which attack sugar beets with a view to finding remedies and means of prevention; the production of single-germ beet seed; the breeding of strains that are alkali-resistant, of strains that mature early, and of strains that are adapted to dry farming; the development of methods for increasing the yield and improving the quality of the beets; the production and improvement of commercial sugar-beet seed, and the extension of the sugar-beet area.

SUGAR-BEET DISEASES.

The leaf-spot and curly-top diseases of the sugar beet proved fully as destructive during the past year as in 1905 or any previous year, and, as has been the case in the past, the leaf-spot disease was injurious only in the central and eastern portions of the country, while the curly-top disease was destructive in the West. Spraying experiments with Bordeaux mixture again proved successful in the control of the leaf-spot; and it was further discovered that the spraying need not be begun until the first spots appear on the leaves, which is generally the latter part of June or the first part of July.

A number of theories in connection with the curly-top disease have been investigated in an endeavor to ascertain its cause, but so far no positive results have been secured.

A number of other diseases, including root-rot and the damping-off disease, were investigated. These diseases for the most part, however, were limited to small areas. A study was also made to determine why seed beets sometimes fail to produce seed stalks. This work was only commenced last year, and as yet there are no results to report.

SINGLE-GERM SEED.

Very gratifying results were obtained in connection with the development of single-germ seed last season, marking a decided advance toward the desired end. Heretofore the highest percentage of single-germ seeds secured from selected plants was 26, which was in 1905, while, in 1904, 25 per cent was the highest from any one plant. During the past season one of the selected plants produced more than 50 per cent of single-germ seeds, two plants produced between 49 and 50, several others produced more than 40, while quite a number showed more than 30 per cent. In view of the fact that, when this work was first undertaken, the percentage of single-germ seed was only about 2, the ultimate success of the project seems to be assured.

EFFECT OF FERTILIZERS.

Experiments to determine the relative values of green crops, stable manure, and commercial fertilizers as applied to sugar beets were continued. Generally speaking, the best results have been obtained from these fertilizers in the order named. In connection with commercial fertilizers it has been found, as a rule, that phosphoric acid has a tendency to ripen beets prematurely, while nitrates delay the ripening period. These experiments will be continued the coming season.

SILOING SEED BEETS.

How to keep seed beets safely through the winter has for some time been perplexing the growers in some sections where seed production has otherwise been successful. In 1904 the outdoor silos proved to be better than sheds for storing the seed beets, while in 1905 many of the beets kept in such silos decayed, and most of those which remained sound did not produce seed. Experiments are in progress to determine the relation, if any, between the method used in keeping the beets and seed production; also to discover the best method of siloing to insure the preservation of the beets during the winter. The results of this work so far would indicate that long, narrow silos give better results than large silos and are better than sheds.

CULTURAL METHODS.

Except in a general way, in no part of the sugar-beet area is it definitely known what cultural methods will give the best results under different conditions of soil and climate. During the season of 1906, experiments were commenced along this line, but it will be necessary to continue this work for several seasons before definite

conclusions can be reached. The distance apart of the rows, the advantages of subsoiling, the time for plowing, and the time and method of preparing seed beds and cultivating the beets are the principal points under investigation.

SELECTION TO SECURE BEETS ADAPTED TO SPECIAL CONDITIONS.

The work of selecting for the purpose of obtaining strains of beets adapted to various conditions of soil and climate, which has been under way for two or three years, has been continued. The principal results sought for are as follows:

(*a*) Increased quality and yield of beets.

(*b*) Early-maturing strains, in order to increase the length of the harvesting season.

(*c*) Strains adapted to the semiarid regions.

(*d*) Strains resistant to alkali for planting in alkaline soils.

While it is yet too early to expect any definite results, the indications are that this work will ultimately be successful.

TESTING COMPARATIVE MERITS OF AMERICAN-GROWN AND FOREIGN-GROWN SUGAR-BEET SEED.

This work was commenced in 1902, and the fifth year of the work has just been completed. Comparative tests have been carried on in Michigan, New York, Colorado, Oregon, Utah, and Washington, partly in cooperation with the State experiment stations, to determine the relative merits of all varieties of seed grown by American seedsmen and seed growers and all imported varieties which are used by two or more factories in the United States.

During the past year this work was conducted by forty-nine experimenters throughout the sugar-beet area, under the direction of this Bureau. On the 278 acres planted, the American-grown seed yielded 14.32 tons of beets per acre with an average sugar content of 14.9 per cent, making a total of 4,267 pounds of sugar per acre, while the imported seed which is used by the various factories gave an average yield of 12.14 tons per acre with a sugar content of 15.1 per cent, making a total of 3,666 pounds of sugar per acre—a difference in favor of the American-grown seed of more than 600 pounds per acre. This, on the 376,000 acres harvested in the United States in 1906, would mean an increase in the total amount of sugar produced, without any additional cost, of about 226,000,000 pounds of sugar.

A publication will probably be issued in about a year's time showing the results of the foregoing experiments. The object of this bulletin will be to impress upon the sugar factories the great importance of securing the best seed obtainable; and this can be done

in graphic form by giving them accurate statistics as to the different percentages of sugar in different varieties and calling their attention to the fact that a difference of 1 per cent of sugar in the beet makes a difference of thousands of dollars in the proceeds from each factory at practically no increase in cost of manufacture.

BREEDING AND ESTABLISHING HIGH-GRADE PEDIGREE STRAINS OF SUGAR-BEET SEED.

The breeding of pedigree strains of seed from individually analyzed and recorded roots has been put on a firm basis in each of the five localities—New York, Utah, Washington, and two points in Michigan—where work is being conducted.

Twenty acres of seed beets, all of which analyzed 22 per cent or more of sugar, were grown on the farm of E. H. Morrison, at Fairfield, Wash., last summer. The seed secured from these beets, amounting to about 15,000 pounds, will be distributed this spring for testing in a commercial way in comparison with the seed used by the various factories throughout the United States.

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